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Type Package

Title Metrics of Difference for Comparing Pairs of Maps or Pairs of Variables

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Description Metrics of difference for comparing pairs of variables or pairs of maps representing real or categorical variables at original and multiple resolutions.

License GPL (>= 2)

BugReports https://github.com/amsantac/differ/issues

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Metrics of Difference for Comparing Pairs of Maps or Pairs of Variables

Description

Metrics of difference for comparing pairs of variables or pairs of maps representing real or categorical variables at original and multiple resolutions.

Details

Package:      diffeR
Type:        Package
Version:     0.0-6
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BugReports:  https://github.com/amsantac/diffeR/issues

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See Also

differenceMetrics

categoryComponentsPlot

Category Components plot
**Description**

If comparison and reference (raster) maps are provided, this function creates the Category Components plot from the comparison between the comparison map (or map at time $t$) and the reference map (or map at time $t+1$). If a square contingency table (matrix) is provided instead of raster maps, then this function creates the Category Components plot from the comparison between the comparison variable (or variable at time $t$) and the reference variable (or variable at time $t+1$).

**Usage**

categoryComponentsPlot(comp = NULL, ref = NULL, ctmatrix = NULL, units = NULL, population = NULL, fontSize = NULL, breaks = waiver(), labels = waiver(), limits = NULL)

**Arguments**

- **comp**: object of class RasterLayer corresponding to a comparison map (or map at time $t$). See Details below
- **ref**: object of class RasterLayer corresponding to a reference map (or map at time $t+1$). See Details below
- **ctmatrix**: matrix representing a square contingency table between a comparison variable or variable at time $t$ (rows) and a reference variable or variable at time $t+1$ (columns). See Details below
- **units**: optional; character string indicating units of `ctmatrix`
- **population**: optional; an $n \times 2$ matrix provided to correct the sample count to population count in the square contingency table. See Details below
- **fontSize**: text size (in pts)
- **breaks**: One of:
  - NULL for no breaks
  - waiver() for the default breaks computed by the transformation object
  - A numeric vector of positions
  - A function that takes the limits as input and returns breaks as output
- **labels**: One of:
  - NULL for no labels
  - waiver() for the default labels computed by the transformation object
  - A character vector giving labels (must be same length as `breaks`)
  - A function that takes the breaks as input and returns labels as output
- **limits**: A numeric vector of length two providing limits of the scale. Use NA to refer to the existing minimum or maximum.

**Details**

Users may enter as input either a square contingency table (`ctmatrix`) or a comparison and a reference raster maps (`comp` and `ref`, respectively).

The first column of `population` must contain integer identifiers of each category, corresponding to the categories in the comparison and reference variables. The second column corresponds to the population totals for each category.
Value

a stacked barplot showing for each category the quantity, exchange and shift components of difference between the comparison map/variable (or map/variable at time t) and the reference map/variable (or map/variable at time t+1)

References


See Also
diffTablej

Examples

```r
comp <- raster(system.file("external/comparison.rst", package="diffeR"))
ref <- raster(system.file("external/reference.rst", package="diffeR"))
categoryComponentsPlot(comp, ref)

cmat <- crosstabs(comp, ref)
categoryComponentsPlot(cmat, units = "pixels")
```

categorySourcesPlot  Category Sources plot

Description

If comparison and reference (raster) maps are provided, this function creates the Category Sources plot from the comparison between the comparison map (or map at time t) and the reference map (or map at time t+1). If a square contingency table (matrix) is provided instead of raster maps, then this function creates the Category Sources plot from the comparison between the comparison variable (or variable at time t) and the reference variable (or variable at time t+1).

Usage

```r
categorySourcesPlot(comp = NULL, ref = NULL, ctmatrix = NULL, analysis = "error",
                      units = NULL, population = NULL, fontSize = NULL, breaks = waiver(),
                      labels = waiver(), limits = NULL)
```

Arguments

- `comp`: object of class RasterLayer corresponding to a comparison map (or map at time t). See Details below
- `ref`: object of class RasterLayer corresponding to a reference map (or map at time t+1). See Details below
categorySourcesPlot

ctmatrix matrix representing a square contingency table between a comparison variable or variable at time $t$ (rows) and a reference variable or variable at time $t+1$ (columns). See Details below

analysis character string indicating type of analysis, either "error" (default) or "change"

units optional; character string indicating units of ctmatrix

population optional; an $n \times 2$ matrix provided to correct the sample count to population count in the square contingency table. See Details below

fontSize text size (in pts)

breaks One of:
• NULL for no breaks
• waiver() for the default breaks computed by the transformation object
• A numeric vector of positions
• A function that takes the limits as input and returns breaks as output

labels One of:
• NULL for no labels
• waiver() for the default labels computed by the transformation object
• A character vector giving labels (must be same length as breaks)
• A function that takes the breaks as input and returns labels as output

limits A numeric vector of length two providing limits of the scale. Use NA to refer to the existing minimum or maximum.

Details

Users may enter as input either a square contingency table (ctmatrix) or a comparison and a reference raster maps (comp and ref, respectively).

The first column of population must contain integer identifiers of each category, corresponding to the categories in the comparison and reference variables. The second column corresponds to the population totals for each category.

Value

a stacked barplot showing for each category the agreement and the omission and comission components of difference between the comparison map/variable (or map/variable at time $t$) and the reference map/variable (or map/variable at time $t+1$)

References


See Also
differenceMetrics
**Examples**

```r
comp <- raster(system.file("external/comparison.rst", package="differ"))
ref <- raster(system.file("external/reference.rst", package="differ"))
categorySourcesPlot(comp, ref)

ctmat <- crosstabm(comp, ref)
categorySourcesPlot(ctmatrix = ctmat, units = "Pixels")
```

---

**composite create a composite matrix**

---

**Description**

provide a method to create a composite matrix from the crosstabulation of a comparison map (or map at time $t$) and a reference map (or map at time $t+1$), both aggregated at a given factor.

**Usage**

```r
composite(comp, ref, factor)
```

**Arguments**

- `comp`: object of class RasterLayer corresponding to a comparison map (or map at time $t$)
- `ref`: object of class RasterLayer corresponding to a reference map (or map at time $t+1$)
- `factor`: integer. Aggregation factor expressed as number of cells in each direction (horizontally and vertically). Or two integers (horizontal and vertical aggregation factor). See raster package for details.

**Details**

the pixel definition in a composite matrix interpretes class membership as the proportion of a pixel that belongs to a class. The pixel contains information about only the quantity of each category (Kuzera and Pontius 2008).

**Value**

a matrix showing the contingency table derived from the crosstabulation of a comparison map (or map at time $t$) and a reference map (or map at time $t+1$), both aggregated at a given factor. Output values are given as proportion (0 to 1).

**References**

crosstabm

See Also

memberships

Examples

```r
comp <- raster(system.file("external/comparison.rst", package="difeR"))
ref <- raster(system.file("external/reference.rst", package="difeR"))
composite(comp, ref, factor=2)
```

---

crosstabm  
create a contingency table between a comparison raster map (rows)  
and a reference raster map (columns)

Description

create a contingency table, also called cross-tabulated matrix, between a comparison raster map  
(rows), or map at time $t$, and a reference raster map (columns), or map at time $t+1$

Usage

crosstabm(comp, ref, percent = FALSE, population = NULL)

Arguments

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>comp</td>
<td>object of class RasterLayer corresponding to the comparison map, or map at time $t$</td>
</tr>
<tr>
<td>ref</td>
<td>object of class RasterLayer corresponding to the reference map, or map at time $t+1$</td>
</tr>
<tr>
<td>percent</td>
<td>logical. If TRUE, output values are given as percentage. If FALSE, output values are given in pixel counts</td>
</tr>
<tr>
<td>population</td>
<td>an $n \times 2$ matrix provided to correct the sample count to population count in the square contingency table. See Details below</td>
</tr>
</tbody>
</table>

Details

For correcting the sample count to population count in the square contingency table, assuming  
a stratified random sampling, an $n$ (number of categories) by 2 matrix can be provided in the population argument. The first column of population must contains integer identifiers of each category, corresponding to the categories in the comparison map (or map at time $t$) and reference map (or map at time $t+1$). The second column corresponds to the population totals for each map category.

Value

a matrix showing the cross-tabulation between the comparison map (or map at time $t$) and the reference map (or map at time $t+1$)
differenceMR

differenceMR calculates difference metrics between a reference map and a comparison map both consecutively aggregated at multiple resolutions.

Description

calculates quantity, exchange and shift components of difference, as well as the overall difference, between a comparison raster map (or map at time \( t \)), and a reference raster map (or map at time \( t+1 \)), both consecutively aggregated at multiple resolutions.

Quantity difference is defined as the amount of difference between the reference map and a comparison map that is due to the less than maximum match in the proportions of the categories. Exchange consists of a transition from category \( i \) to category \( j \) in some pixels and a transition from category \( j \) to category \( i \) in an identical number of other pixels. Shift refers to the difference remaining after subtracting quantity difference and exchange from the overall difference.

Usage

differenceMR(comp, ref, eval = "multiple", percent = TRUE, fact = 2, population = NULL)

Arguments

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>comp</td>
<td>object of class RasterLayer corresponding to the comparison map, or map at time ( t )</td>
</tr>
<tr>
<td>ref</td>
<td>object of class RasterLayer corresponding to the reference map, or map at time ( t+1 )</td>
</tr>
<tr>
<td>eval</td>
<td>default &quot;original&quot;, return difference metrics between the input raster maps at the original resolution; if &quot;multiple&quot;, return difference metrics at multiple resolutions aggregated according to a geometric sequence</td>
</tr>
<tr>
<td>percent</td>
<td>logical. If TRUE, output value is given as percentage. If FALSE, output value is given as proportion (0 to 1)</td>
</tr>
</tbody>
</table>

See Also

memberships

Examples

```r
comp <- raster(system.file("external/comparison.rst", package="diffeR"))
ref <- raster(system.file("external/reference.rst", package="diffeR"))
crosstabm(comp, ref)

# Population-adjusted square contingency table
(population <- matrix(c(1,2,3,2000,4000,6000), ncol=2))
crosstabm(comp, ref, population = population)

# Population-adjusted square contingency table, output as percentage
crosstabm(comp, ref, percent=TRUE, population = population)
```

```r
differencemr

differencemr calculates difference metrics between a reference map and a comparison map both consecutively aggregated at multiple resolutions.

See Also

memberships

Examples

```r
comp <- raster(system.file("external/comparison.rst", package="diffeR"))
ref <- raster(system.file("external/reference.rst", package="diffeR"))
crosstabm(comp, ref)

# Population-adjusted square contingency table
(population <- matrix(c(1,2,3,2000,4000,6000), ncol=2))
crosstabm(comp, ref, population = population)

# Population-adjusted square contingency table, output as percentage
crosstabm(comp, ref, percent=TRUE, population = population)
```
fact integer. Aggregation factor expressed as number of cells in each direction (horizontally and vertically). Or two integers (horizontal and vertical aggregation factor). See raster package for details.

population an n x 2 matrix provided to correct the sample count to population count in the square contingency table. See Details below.

Details

For correcting the sample count to population count in the square contingency table, assuming a stratified random sampling, an n (number of categories) by 2 matrix can be provided in the population argument. The first column of population must contains integer identifiers of each category, corresponding to the categories in the comparison map (or map at time t) and reference map (or map at time t+1). The second column corresponds to the population totals for each map category.

Value
data.frame containing quantity, exchange and shift components of difference, as well as the overall difference, between the comparison map and the reference map at multiple resolutions.

References


See Also
differenceMetrics

Examples

```r
## Not run:
comp <- raster(system.file("external/comparison.rst", package="differR"))
ref <- raster(system.file("external/reference.rst", package="differR"))
differencemr(comp, ref, eval="original")
differencemr(comp, ref, eval="multiple", fact=2)

## End(Not run)
```
diffTablej calculates difference metrics at the category level from a square contingency table

Description

calculates quantity, exchange and shift components of difference, as well as the overall difference, at the category level from a contingency table derived from the crosstabulation between a comparison variable (or variable at time $t$), and a reference variable (or variable at time $t+1$).

Quantity difference is defined as the amount of difference between the reference variable and a comparison variable that is due to the less than maximum match in the proportions of the categories. Exchange consists of a transition from category $i$ to category $j$ in some observations and a transition from category $j$ to category $i$ in an identical number of other observations. Shift refers to the difference remaining after subtracting quantity difference and exchange from the overall difference.

Usage

diffTablej(ctmatrix, digits = 0, analysis = "error")

Arguments

cmtx
matrix representing a square contingency table between a comparison variable (rows) and a reference variable (columns)

digits
integer indicating the number of decimal places to be used

analysis
character string either "error" (default) or "change". The output table shows category-level omission error, agreement and comission error in the "error" analysis, and category-level gain, persistence and loss in the "change" analysis.

Value

data.frame containing difference metrics at the category level between a comparison variable (rows) and a reference variable (columns). Output values are given in the same units as c mtx

References


See Also

differenceMetrics
Examples

```r
comp <- raster(system.file("external/comparison.rst", package="differ"))
ref <- raster(system.file("external/reference.rst", package="differ"))
ctmatCompRef <- crosstabm(comp, ref)
diffTablej(ctmatCompRef)

# Adjustment to population assuming a stratified random sampling
(population <- matrix(c(1,2,3,2000,4000,6000), ncol = 2))
ctmatCompRef <- crosstabm(comp, ref, percent = TRUE, population = population)
diffTablej(ctmatCompRef)
```

---

**MAD**

**Mean Absolute Deviation (MAD)**

**Description**

Provides a method to compare the quantity difference and allocation difference between two images of the same real variable at the original resolution or at multiple resolutions. The output provides a stacked graph and an accompanying numerical table for the Mean Absolute Deviation (MAD) for the difference due to quantity, the difference due to stratum-level allocation, and difference due to pixel-level allocation. The output also indicates which image has a smaller average. A scatterplot indicating the distribution of values in relation to the 1:1 line can be produced with `MADscatterplot`.

**Usage**

```r
MAD(grid1, grid2, strata = NULL, eval = "original")
```

**Arguments**

- `grid1`: object of class `RasterLayer` corresponding to the first image
- `grid2`: object of class `RasterLayer` corresponding to the second image
- `strata`: object of class `RasterLayer` corresponding to the mask or strata image
- `eval`: default "original", return the MAD value for the original resolution; if "multiple", return the MAD values for multiple resolutions following a geometric sequence

**Value**

A dataframe containing the multiples of the original resolution, the corresponding aggregated resolution, the difference due to quantity, the difference due to stratum-level allocation, and the difference due to pixel-level allocation.

**References**

MAD Scatterplot

Description

Generates a scatterplot indicating the distribution of values from two images in relation to the 1:1 line

Usage

MADscatterplot(grid1, grid2, strata = NULL)

Arguments

grid1 object of class RasterLayer corresponding to the first image
grid2 object of class RasterLayer corresponding to the second image
strata object of class RasterLayer corresponding to the mask or strata image

Value

a ggplot object corresponding to the scatterplot

See Also

MAD
memberships

Examples

oldNpar <- par(no.readonly = TRUE)
grid1 <- raster(system.file("external/GRID1_INT.rst", package="differR"))
grid2 <- raster(system.file("external/GRID2_INT.rst", package="differR"))
strata <- raster(system.file("external/strata_int.rst", package="differR"))
MADscatterplot(grid1, grid2, strata)

veg_obs1 <- raster(system.file("external/veg_obs1.rst", package="differR"))
veg_pre1 <- raster(system.file("external/veg_pre1.rst", package="differR"))
veg_mask1 <- raster(system.file("external/veg_mask1.rst", package="differR"))
MADscatterplot(veg_obs1, veg_pre1, veg_mask1)
par(old.par)

memberships produces membership values for each category in the input raster at a specified aggregated resolution

Description

Calculates membership values for each category in the input raster at a specified aggregated resolution

Usage

memberships(grid, fact = 2)

Arguments

grid object of class RasterLayer

fact integer. Aggregation factor expressed as number of cells in each direction (horizontally and vertically). Or two integers (horizontal and vertical aggregation factor). See raster package for details

Value

a RasterBrick object containing membership values for each category in the input raster at a specified aggregated resolution

See Also

composite

Examples

ref <- raster(system.file("external/reference.rst", package="differR"))
plot(ref)
memb.ref <- memberships(ref, fact=2)
names(memb.ref) <- c("ref.A", "ref.B", "ref.C")
plot(memb.ref)
**overallComponentsPlot**  
*Overall Components plot*

**Description**

If comparison and reference (raster) maps are provided, this function creates the Overall Components plot from the comparison between the comparison map (or map at time \(t\)) and the reference map (or map at time \(t+1\)). If a square contingency table (matrix) is provided instead of raster maps, then this function creates the Overall Components plot from the comparison between the comparison variable (or variable at time \(t\)) and the reference variable (or variable at time \(t+1\)).

**Usage**

```r
overallComponentsPlot(comp = NULL, ref = NULL, ctmatrix = NULL, units = NULL, population = NULL)
```

**Arguments**

- `comp` object of class RasterLayer corresponding to a comparison map (or map at time \(t\)). See Details below
- `ref` object of class RasterLayer corresponding to a reference map (or map at time \(t+1\)). See Details below
- `ctmatrix` matrix representing a square contingency table between a comparison variable (rows) and a reference variable (columns). See Details below
- `units` character string indicating units of `ctmatrix`
- `population` an \(n \times 2\) matrix provided to correct the sample count to population count in the square contingency table. See Details below

**Details**

Users may enter as input either a square contingency table (`ctmatrix`) or a comparison and a reference raster maps (`comp` and `ref`, respectively).

The first column of `population` must contain integer identifiers of each category, corresponding to the categories in the comparison and reference variables. The second column corresponds to the population totals for each category.

**Value**

a stacked barplot showing the quantity, exchange and shift components of difference between the comparison map/variable (or map/variable at time \(t\)) and the reference map/variable (or map/variable at time \(t+1\))

**References**

See Also
differenceMetrics

Examples

```r
comp <- raster(system.file("external/comparison.rst", package="diffR"))
ref <- raster(system.file("external/reference.rst", package="diffR"))
overallComponentsPlot(comp, ref)

cmat <- crosstabm(comp, ref)
overallComponentsPlot(ctmatrix = cmat, units = "pixels")
```

---

Description

If comparison and reference (raster) maps are provided, this function creates the Overall Sources plot from the comparison between the comparison map (or map at time \( t \)) and the reference map (or map at time \( t + 1 \)). If a square contingency table (matrix) is provided instead of raster maps, then this function creates the Overall Sources plot from the comparison between the comparison variable (or variable at time \( t \)) and the reference variable (or variable at time \( t + 1 \)).

Usage

```r
overallSourcesPlot(comp = NULL, ref = NULL, ctmatrix = NULL, analysis = "error",
                   units = NULL, population = NULL, fontSize = NULL, colorValues = NULL,
                   breaks = waiver(), labels = waiver(), limits = NULL)
```

Arguments

- **comp**: object of class RasterLayer corresponding to a comparison map (or map at time \( t \)). See Details below
- **ref**: object of class RasterLayer corresponding to a reference map (or map at time \( t + 1 \)). See Details below
- **ctmatrix**: matrix representing a square contingency table between a comparison variable (rows) and a reference variable (columns). See Details below
- **analysis**: character string indicating type of analysis, either "error" (default) or "change"
- **units**: character string indicating units of ctmatrix
- **population**: an \( n \) x 2 matrix provided to correct the sample count to population count in the square contingency table. See Details below
- **fontSize**: text size (in pts)
- **colorValues**: a set of aesthetic values to map data values to. If this is a named vector, then the values will be matched based on the names. If unnamed, values will be matched in order (usually alphabetical) with the limits of the scale. Any data values that don’t match will be given na.value.
overallSourcesPlot

breaks One of:
- NULL for no breaks
- waiver() for the default breaks computed by the transformation object
- A numeric vector of positions
- A function that takes the limits as input and returns breaks as output

labels One of:
- NULL for no labels
- waiver() for the default labels computed by the transformation object
- A character vector giving labels (must be same length as breaks)
- A function that takes the breaks as input and returns labels as output

limits A numeric vector of length two providing limits of the scale. Use NA to refer to the existing minimum or maximum.

Details

Users may enter as input either a square contingency table (ctmatrix) or a comparison and a reference raster maps (comp and ref, respectively).

The first column of population must contain integer identifiers of each category, corresponding to the categories in the comparison and reference variables. The second column corresponds to the population totals for each category.

Value

a stacked barplot showing the omission and comission components of difference between the comparison map/variable (or map/variable at time \( t \)) and the reference map/variable (or map/variable at time \( t+1 \))

References


See Also
differencemetrics

Examples

```r
comp <- raster(system.file("external/comparison.rst", package="diffeR"))
ref <- raster(system.file("external/reference.rst", package="diffeR"))
overallSourcesPlot(comp, ref)

cmat <- crosstabm(comp, ref)
overallSourcesPlot(ctmatrix = cmat, units = "pixels")
```
sample2pop

**Description**

Converts sample count to population count in the square contingency table, assuming a stratified random sampling

**Usage**

```r
sample2pop(ctmatrix, population)
```

**Arguments**

- `ctmatrix`: matrix representing a sampling-derived square contingency table between a comparison variable (rows) and a reference variable (columns)
- `population`: an \( n \times 2 \) matrix provided to correct the sample count to population count in the square contingency table. See Details below

**Details**

The first column of `population` must contain integer identifiers of each category, corresponding to the categories in the comparison and reference variables. The second column corresponds to the population totals for each category.

**Value**

matrix representing a population-adjusted square contingency table for the crosstabulation between a comparison variable (rows) and a reference variable (columns). Output values are given in the same units as `ctmatrix`

**See Also**

crosstabm

**Examples**

```r
comp <- raster(system.file("external/comparison.rst", package="diffeR"))
ref <- raster(system.file("external/reference.rst", package="diffeR"))

# Sample square contingency table
(ctmatCompRef <- crosstabm(comp, ref))

# Population-adjusted square contingency table
(population <- matrix(c(1,2,3,2000,4000,0,000), ncol=2))
sample2pop(ctmatCompRef, population = population)
```
# The square contingency table can also be adjusted directly using the crosstabm function
crosstabm(comp, ref, population = population)
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