

# Package ‘somspace’

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**Type** Package

**Title** Spatial Analysis with Self-Organizing Maps

**Version** 1.0.0

**Description** Application of the Self-Organizing Maps technique for spatial classification of time series. The package uses spatial data, point or gridded, to create clusters with similar characteristics. The clusters can be further refined to a smaller number of regions by hierarchical clustering and their spatial dependencies can be presented as complex networks. Thus, meaningful maps can be created, representing the regional heterogeneity of a single variable. More information and an example of implementation can be found in Markonis and Strnad (2019).

**License** GPL-3

**Depends** R (>= 3.4.0), ggplot2, data.table, kohonen, maps

**Encoding** UTF-8

**LazyData** true

**RoxygenNote** 6.1.1

**Suggests** knitr, rmarkdown, testthat

**VignetteBuilder** knitr

**NeedsCompilation** no

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cnet *Complex network analysis*

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## Description

cnet plots the canonical network map of a single classification scheme.

## Usage

```
cnet(x, n, thres)
```

## Arguments

x	regs object.
n	number of regions.
thres	the cross-correlation threshold of the network.

## Details

The cnet function estimates the cross-correlation matrix of the average time series of each region and plots a map linking the regions with cross-correlations above the selected threshold.

## Examples

```
dummy <- owda[Time <= 1600] #toy example
inp_som <- sominp(dummy)
my_som <- somspa(inp_som, rlen = 100, grid = somgrid(3, 3, "hexagonal"))
my_regions <- somregs(my_som, nregions = 6)
cnet(my_regions, n = 5, thres = 0.2)

inp_som <- sominp(owda)
my_som <- somspa(inp_som, rlen = 1000, grid = somgrid(6, 6, "hexagonal"))
my_regions <- somregs(my_som, nregions = 15)
cnet(my_regions, n = 12, thres = 0.3)
```

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owda	<i>Old World Drought Atlas (1500-2012)</i>
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**Description**

Reconstruction of European hydroclimate derived from tree-rings. The variable used is self-calibrated Palmer Drought Severity Index (scPDSI) at annual time step.

**Usage**

```
data(owda)
```

**Format**

An object of class `data.table` (inherits from `data.frame`) with 1355264 rows and 4 columns.

**Source**

[FZP archive](#)

**References**

Markonis et al. (2018) Nature Communications 9(1):1767 ([Nature Springer](#))

**Examples**

```
str(owda)
```

---

plot_ts	<i>Plot time series</i>
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**Description**

Plots the time series of SOM nodes or regions mean

**Usage**

```
plot_ts(x, n)
```

**Arguments**

x	is either a <code>somsp</code> or a <code>regs</code> object
n	is either the set of nodes for <code>somsp</code> or the number of regions for <code>regs</code>

**Details**

In case of `regs`, all the regions are plotted.

**See Also**[somspa](#)

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`regs`*Regions class*

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**Description**

Regions class

**Usage**`regs`**Format**An object of class `regs` of length 0.**Details**The `regs` class contains:

- A `summary.data.table` which updates the `somsp` object with the region ids of all classification schemes up to `nregions`. Each different classification scheme is stored as an individual region, e.g. `regions.2`, `regions.3`, etc.
- A `data.table` with the original data set, as in `somsp`.

It can be plotted by `plot` and `plot_ts`. If `plot` is used, three additional arguments are needed; a set with the classification schemes that will be plotted, number of rows and number of columns of the plotted panels. `plot_ts` plots all the time series of a given classification scheme.

**See Also**[somsp](#)[somregs](#)

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sominp *Create sominp object*

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### Description

sominp transforms the data set from `data.table` to `somsp` format, which can be used as argument in the `somspa` function.

### Usage

```
sominp(x)
```

### Arguments

`x` The `data.table` object which will be transformed to `somsp` object.

### Details

`x` should be in tidy format with four columns: time, latitude, longitude and variable.

### Value

A `sominp` object. It contains:

- a matrix that can be used as input for the `som` function of the `kohonen` package.
- a `data.table` with the with spatial point coordinates and a corresponding id.
- a `data.table` with the original dataset.

### See Also

[somspa](#)

### Examples

```
dummy <- owda[Time <= 1510] #toy example
inp_som <- sominp(dummy)
```

```
inp_som <- sominp(owda)
```

---

`somregs`*Classify SOM into regions*

---

### Description

`somregs` applies hierarchical cluster analysis to the Self-Organizing Map to form regions with homogeneous characteristics (classification scheme).

### Usage

```
somregs(x, nregions, ...)
```

### Arguments

<code>x</code>	A <code>somsp</code> object.
<code>nregions</code>	The maximum number of classifications schemes to be determined starting from 2.
<code>...</code>	Other arguments passed to methods from <code>hclust</code> function which is used to determine the regions.

### Details

`nregions` must be at least two, i.e., a classification scheme with two regions, and smaller than the number of SOM nodes. In the latter case, each SOM node corresponds to a region. The resulting `regs` object can be plotted by `plot` and `plot_ts`. If `plot` is used, three additional arguments are needed; a set with the classification schemes that will be plotted, number of rows and number of columns of the plotted panels. `plot_ts` plots all the time series of a given classification scheme.

### Value

A `regs` object, which contains:

- A summary `data.table` which updates the `somsp` object with the region ids of all classification schemes up to `nregions`. Each different classification scheme is stored as an individual region, e.g., `regions.2`, `regions.3`, etc. to their corresponding winning unit, the number of points of each node, as well as the median latitude and longitude of each node coordinates and their standard deviation.
- The original time series which created the SOM as a `data.table`, as in `somsp`.

### See Also

[somsp](#)

[somspa](#)

## Examples

```
dummy <- owda[Time <= 1600] #toy example
inp_som <- sominp(dummy)
my_som <- somspa(inp_som, rlen = 100, grid = somgrid(4, 4, "hexagonal"))
my_regions <- somregs(my_som, nregions = 9)
plot(my_regions, regions = c(2, 4, 6, 8), nrow = 2, ncol = 2)
plot_ts(my_regions, n = 4)

inp_som <- sominp(owda)
my_som <- somspa(inp_som)
my_regions <- somregs(my_som, nregions = 15)
plot(my_regions, regions = c(2, 5, 9, 13), nrow = 2, ncol = 2)
plot_ts(my_regions, n = 9)
```

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somsp

*Spatial SOM class*

---

## Description

Spatial SOM class

## Usage

somsp

## Format

An object of class somsp of length 0.

## Details

The somsp objects are created by somspa function and contain:

- A summary data.table with the coordinates of each SOM node, the distances of objects to their corresponding winning unit, the number of points of each node, as well as the median latitude and longitude of each node coordinates and their standard deviation.
- A Self-Organizing Map object (see also [kohonen](#)).
- The sominp object used as input for the SOM, with an id number corresponding to location and a node number to the classification group of SOM.

They can be plotted by plot and plot\_ts functions or summarized by summary.

## See Also

[somspa](#)

[plot\\_ts](#)

somspa

*Spatial SOM*

---

**Description**

somspa creates a Self-Organizing Map from spatial data.

**Usage**

```
somspa(x, ...)
```

**Arguments**

x	A sominp object.
...	Other arguments passed to methods from kohonen: : som function which is used to create the SOM.

**Details**

x should be created by sominp. The output somsp objects can be plotted by plot and plot\_ts functions or summarized by summary

**Value**

A somsp object, which contains:

- A summary data.table with the coordinates of each SOM node, the distances of objects to their corresponding winning unit, the number of points of each node, as well as the median latitude and longitude of each node coordinates and their standard deviation.
- A Self-Organizing Map object (see also [kohonen](#)).
- The sominp object used as input for the SOM, with an id number corresponding to location and a node number to the classification group of SOM.

**See Also**

[som](#)

[sominp](#)



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