

Package ‘SOMEnv’

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Type Package

Title SOM Algorithm for the Analysis of Multivariate Environmental Data

Version 1.1.2

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Description Analysis of multivariate environmental high frequency data by Self-Organizing Map and k-means clustering algorithms. By means of the graphical user interface it provides a comfortable way to elaborate by self-organizing map algorithm rather big datasets (txt files up to 100 MB) obtained by environmental high-frequency monitoring by sensors/instruments. The functions present in the package are based on 'kohonen' and 'openair' packages implemented by functions embedding Vesanto et al. (2001) <<http://www.cis.hut.fi/projects/somtoolbox/package/papers/techrep.pdf>> heuristic rules for map initialization parameters, k-means clustering algorithm and map features visualization. Cluster profiles visualization as well as graphs dedicated to the visualization of time-dependent variables Lichen et al. (2020) <[doi:10.4209/aaqr.2019.08.0414](https://doi.org/10.4209/aaqr.2019.08.0414)> are provided.

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Encoding UTF-8

Depends R (>= 3.6.0)

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Imports rlist, kohonen, shiny, dplyr, plyr, openair, colourpicker, shinycssloaders, shinycustomloader

URL <https://github.com/SomEnv/somenv>

BugReports <https://github.com/SomEnv/somenv/issues>

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 BmusCentr

BMUs of the cluster centroids

Description

The function finds the Best Matching Units of the cluster centroids

Usage

```
BmusCentr(centroids, som_model, k)
```

Arguments

centroids	Centroids array (output of kmeans_clustersR function)
som_model	An object of class kohonen
k	Number of clusters

Value

An array containing the BMU for each centroid

Author(s)

Sabina Licen

References

Licen, S., Cozzutto, S., Barbieri, P. (2020) Aerosol Air Qual. Res., 20 (4), pp. 800-809. DOI: 10.4209/aaqr.2019.08.0414

BmusClus

Cluster assignment for the experimental data

Description

Generate a vector containing the cluster assignment to experimental data

Usage

```
BmusClus(Bmus, Cluster)
```

Arguments

Bmus	Best Matching Unit assignment to the experimental data
Cluster	Vector containing cluster number assignment for prototypes

Value

A vector containing the cluster assignment to experimental data

Author(s)

Sabina Licen

References

Licen, S., Cozzutto, S., Barbieri, P. (2020) Aerosol Air Qual. Res., 20 (4), pp. 800-809. DOI: 10.4209/aaqr.2019.08.0414

BoxClus

Boxplot of prototype variables split by cluster and variable

Description

Boxplot function is used, box whiskers are omitted

Usage

```
BoxClus(Dms, codebook, Cluster, Centroids)
```

Arguments

Dms	A vector of length 2, where the first argument specifies the number of rows and the second the number of columns of plots (see mfrow in par)
codebook	De-normalized prototype codebook
Cluster	Vector containing cluster number assignment for prototypes
Centroids	Centroids matrix

Value

Boxplot of prototype variables split by cluster

Author(s)

Sabina Licen

References

Licen, S., Cozzutto, S., Barbieri, P. (2020) Aerosol Air Qual. Res., 20 (4), pp. 800-809. DOI: 10.4209/aaqr.2019.08.0414

See Also

boxplot, par

BoxUnits *Boxplot of prototype variables split by cluster*

Description

Boxplot function is used, box whiskers are omitted

Usage

```
BoxUnits(codebook, Cluster, Centroids, Ylim = NA, pitch = NA, xdim = 0.75)
```

Arguments

codebook	Prototype codebook normalized by variable
Cluster	Vector containing cluster number assignment for prototypes
Centroids	Centroids matrix
Ylim	Vector of length 2 for y-axis limits
pitch	Vector containing the position of horizontal grid lines
xdim	x axes label dimensions

Value

Boxplot of prototype variables split by cluster

Author(s)

Sabina Licen

References

Licen, S., Cozzutto, S., Barbieri, P. (2020) Aerosol Air Qual. Res., 20 (4), pp. 800-809. DOI: 10.4209/aaqr.2019.08.0414

See Also

boxplot

ClusCol *Custom color sequence for clusters*

Description

Generate the sequence of colors to plot the SOM map according to clusters

Usage

```
ClusCol(Centroids, Cluster, colSeq = rainbow(nrow(data.frame(Centroids))))
```

Arguments

Centroids	Centroids matrix
Cluster	Vector containing cluster number assignment for prototypes
colSeq	Color sequence for the clusters

Value

A vector of colors with length equal to Cluster

Author(s)

Sabina Licen

References

Licen, S., Cozzutto, S., Barbieri, P. (2020) Aerosol Air Qual. Res., 20 (4), pp. 800-809. DOI: 10.4209/aaqr.2019.08.0414

CodeCoord *Prototype coordinates for graph*

Description

Generate X and Y coordinates for plotting a SOM map shaped according to Vesanto visualization fashion

Usage

```
CodeCoord(Row, Col)
```

Arguments

Row	Number of SOM map rows
Col	Number of SOM map columns

Value

This function returns a data.frame including columns:

- X
- Y

Author(s)

Sabina Licen, Pierluigi Barbieri

References

J. Vesanto, J. Himberg, E. Alhoniemi, J. Parhankagas, SOM Toolbox for Matlab 5, Report A57, 2000, Available at: www.cis.hut.fi/projects/somtoolbox/package/papers/techrep.pdf; Licen, S., Cozzutto, S., Barbieri, P. (2020) Aerosol Air Qual. Res., 20 (4), pp. 800-809. DOI: 10.4209/aaqr.2019.08.0414

Examples

```
Coord<-CodeCoord(10,5)
```

DailyBar

Plot of daily percentages for each cluster

Description

The function produces a plot representing the the daily percentage for each cluster

Usage

```
DailyBar(
  experimental,
  TrainClus,
  Centroids,
  colSeq = rainbow(nrow(data.frame(Centroids))),
  Total = 1440,
  xdim = 0.7,
  ydim = 0.8
)
```

Arguments

experimental	Experimental data (must contain variable "date")
TrainClus	Vector containing cluster number assignment for experimental data
Centroids	Centroids matrix
colSeq	Color sequence for the clusters
Total	Number of observations per day
xdim	x axes label dimensions
ydim	y axes label dimensions

Value

Plot of daily percentages for each cluster, the latter element in the legend represents percentage of not determined data

Author(s)

Sabina Licen

References

Licen, S., Cozzutto, S., Barbieri, P. (2020) Aerosol Air Qual. Res., 20 (4), pp. 800-809. DOI: 10.4209/aaqr.2019.08.0414

db_indexR

Evaluate Davis-Bouldin index for the cluster split of data input

Description

The function has been coded in R code starting from db_index.m script present in somtoolbox for Matlab by Vesanto and adapted for the use in the shiny app

Usage

```
db_indexR(codebook, k_best, c_best)
```

Arguments

codebook	SOM codebook
k_best	Vector with cluster number assignment for each sample
c_best	Matrix with cluster centroids

Value

The mean DB-index for the clustering

Author(s)

Sabina Licen, Pierluigi Barbieri

References

J. Vesanto, J. Himberg, E. Alhoniemi, J. Parhankagas, SOM Toolbox for Matlab 5, Report A57, 2000, Available at: www.cis.hut.fi/projects/somtoolbox/package/papers/techrep.pdf

See Also

som_mdistr, kmeans_clustersRProg

Freq	<i>Percentage frequency for each cluster</i>
------	--

Description

Percentage frequency for each cluster

Usage

Freq(Cluster, Centroids)

Arguments

Cluster	Vector containing cluster number assignment for experimental data
Centroids	Centroids matrix

Value

A data frame containing the percentage frequency of each cluster

Author(s)

Sabina Licen

References

Licen, S., Cozzutto, S., Barbieri, P. (2020) Aerosol Air Qual. Res., 20 (4), pp. 800-809. DOI: 10.4209/aaqr.2019.08.0414

FreqD	<i>Daily percentage frequency for each cluster</i>
-------	--

Description

Daily percentage frequency for each cluster

Usage

FreqD(Date, Cluster, Centroids, Total = 1440)

Arguments

Date	Vector containing date/time variable for experimental data
Cluster	Vector containing cluster number assignment for experimental data
Centroids	Centroids matrix
Total	Number of observations per day

Value

A data frame containing the daily percentage frequency of each cluster

Author(s)

Sabina Licen

References

Licen, S., Cozzutto, S., Barbieri, P. (2020) Aerosol Air Qual. Res., 20 (4), pp. 800-809. DOI: 10.4209/aaqr.2019.08.0414

FreqM

Monthly percentage frequency for each cluster

Description

Monthly percentage frequency for each cluster

Usage

FreqM(Date, Cluster, Centroids)

Arguments

Date	Vector containing date/time variable for experimental data
Cluster	Vector containing cluster number assignment for experimental data
Centroids	Centroids matrix

Value

A data frame containing the monthly percentage frequency of each cluster

Author(s)

Sabina Licen

References

Licen, S., Cozzutto, S., Barbieri, P. (2020) Aerosol Air Qual. Res., 20 (4), pp. 800-809. DOI: 10.4209/aaqr.2019.08.0414

Hexa	<i>Function to draw an hexagon around a point</i>
------	---

Description

Draws an hexagon around a point of x and y coordinates

Usage

```
Hexa(x, y, color = NA, border = "gray", unitcell = 1)
```

Arguments

x	X-coordinate of the hexagon center
y	Y-coordinate of the hexagon center
color	Filling color of the hexagon (default NA)
border	Border color of the hexagon (default "gray")
unitcell	The distance side to side between two parallel sides of the hexagon (default 1)

Value

This function draws an hexagon on a plot

Author(s)

Sabina Licen

Hexagons	<i>Function to draw an hexagonal SOM map</i>
----------	--

Description

Draws an hexagonal SOM map using x, y coordinates for the hexagon centers

Usage

```
Hexagons(Coords, Row, Col, color = NA, border = "gray", unitcell = 1)
```

Arguments

Coords	matrix containing the x and y coordinates of the hexagon centers
Row	Number of SOM map rows
Col	Number of SOM map columns
color	Filling color of the hexagons (default NA)
border	Border color of the hexagons (default "gray")
unitcell	The distance side to side between two parallel sides of the hexagon (default 1)

Value

A hexagonal SOM map

Author(s)

Sabina Licen

References

Licen, S., Cozzutto, S., Barbieri, P. (2020) Aerosol Air Qual. Res., 20 (4), pp. 800-809. DOI: 10.4209/aaqr.2019.08.0414

Examples

```
Coord<-CodeCoord(10,5)
Hexagons(Coord,10,5)
```

HexagonsClus

SOM map with clusters

Description

Generates a SOM map colored according to cluster splitting

Usage

```
HexagonsClus(
  Centroids,
  Cluster,
  BCentr,
  Coord,
  Row,
  Col,
  colSeq = rainbow(nrow(Centroids))
)
```

Arguments

Centroids	Centroids matrix
Cluster	Vector containing cluster number assignment for prototypes
BCentr	Best Matching Unit of the cluster centroids
Coord	Prototype coordinates for plotting the map
Row	Number of SOM map rows
Col	Number of SOM map columns
colSeq	Color sequence for the clusters

Value

A SOM map colored according to cluster splitting

Author(s)

Sabina Licen

References

Licen, S., Cozzutto, S., Barbieri, P. (2020) Aerosol Air Qual. Res., 20 (4), pp. 800-809. DOI: 10.4209/aaqr.2019.08.0414

HexagonsVar

Heatmaps

Description

Multiple plots that show the distribution of the modeled variables on the SOM map

Usage

HexagonsVar(Dms, codebook, Coords, Row, Col)

Arguments

Dms	A vector of length 2, where the first argument specifies the number of rows and the second the number of columns of plots (see mfrow in par)
codebook	SOM codebook
Coords	Prototype coordinates for plotting the map
Row	Number of SOM map rows
Col	Number of SOM map columns

Details

The function plots a SOM map for the values of each modeled variable using a grayscale according to quartiles, from white (lower outliers), followed by grayscale (quartiles) and black (upper outliers). The outliers and quartiles are evaluated by boxplot function applying default parameters.

Value

SOM map plots for the values of each modeled variable using a grayscale according to quartiles

Author(s)

Sabina Licen

References

Licen, S., Cozzutto, S., Barbieri, P. (2020) Aerosol Air Qual. Res., 20 (4), pp. 800-809. DOI: 10.4209/aaqr.2019.08.0414

See Also

boxplot, par

HexaHits

Hits distribution on the SOM map

Description

Plot a SOM map with filled hexagons according to the number of hits

Usage

```
HexaHits(hits, Coord, Row, Col, color = "black")
```

Arguments

hits	Vector with number of hits for each prototype
Coord	Prototype coordinates for plotting the map
Row	Number of SOM map rows
Col	Number of SOM map columns
color	color filling of the hexagons

Value

Plot a SOM map with filled hexagons according to the number of hits

Author(s)

Sabina Licen

References

Licen, S., Cozzutto, S., Barbieri, P. (2020) Aerosol Air Qual. Res., 20 (4), pp. 800-809. DOI: 10.4209/aaqr.2019.08.0414

`HexaHitsQuant`*Hits distribution on the SOM map*

Description

Plot a SOM map with hits plotted as grayscale according to quartiles

Usage

```
HexaHitsQuant(hits, Coord, Row, Col)
```

Arguments

<code>hits</code>	Vector with number of hits for each prototype
<code>Coord</code>	Prototype coordinates for plotting the map
<code>Row</code>	Number of SOM map rows
<code>Col</code>	Number of SOM map columns

Details

The function plots a SOM map with hits represented as grayscale according to quartiles, from white (lower outliers) followed by grayscale (quartiles) and black (upper outliers). The prototype with the maximum number of hits is represented by a red hexagon. The outliers and quartiles are evaluated by boxplot function applying default parameters.

Value

Plot a SOM map with hits represented as grayscale according to quartiles

Author(s)

Sabina Licen

References

Licen, S., Cozzutto, S., Barbieri, P. (2020) Aerosol Air Qual. Res., 20 (4), pp. 800-809. DOI: 10.4209/aaqr.2019.08.0414

See Also

boxplot

HexaQerrs

Relative quantization error distribution on the SOM map

Description

Plot a SOM map with relative quantization error plotted as grayscale according to quartiles

Usage

```
HexaQerrs(bmus, qerrs, Coord, Row, Col, color = "black")
```

Arguments

bmus	Vector with Best Matching Unit for each experimental sample
qerrs	Vector with quantization error for each experimental sample
Coord	Prototype coordinates for plotting the map
Row	Number of SOM map rows
Col	Number of SOM map columns
color	color filling of the hexagonsType a message

Details

The function evaluate the relative quantization error for each prototype dividing the sum of quantization errors for experimental samples represented by the single prototype by the number of hits of the same prototype, then plots a SOM map with filled hexagons according to the relative quantization error

Value

Plot a SOM map with filled hexagons according to the relative quantization error

Author(s)

Sabina Licen

References

Licen, S., Cozzutto, S., Barbieri, P. (2020) Aerosol Air Qual. Res., 20 (4), pp. 800-809. DOI: 10.4209/aaqr.2019.08.0414

`HexaQerrsQuant`*Relative quantization error distribution on the SOM map*

Description

Plot a SOM map with relative quantization error plotted as grayscale according to quartiles

Usage

```
HexaQerrsQuant(bmus, qerrs, Coord, Row, Col)
```

Arguments

<code>bmus</code>	Vector with Best Matching Unit for each experimental sample
<code>qerrs</code>	Vector with quantization error for each experimental sample
<code>Coord</code>	Prototype coordinates for plotting the map
<code>Row</code>	Number of SOM map rows
<code>Col</code>	Number of SOM map columns

Details

The function evaluate the relative quantization error for each prototype dividing the sum of quantization errors for experimental sample represented by the single prototype by the number of hits of the same prototype, then plots a SOM map with the relative quantization error represented as grayscale according to quartiles, from white (lower outliers) followed by grayscale (quartiles) and black (upper outliers). The outliers and quartiles are evaluated by boxplot function applying default parameters.

Value

Plot a SOM map with relative quantization error represented as grayscale according to quartiles

Author(s)

S. Licen

References

Licen, S., Cozzutto, S., Barbieri, P. (2020) Aerosol Air Qual. Res., 20 (4), pp. 800-809. DOI: 10.4209/aaqr.2019.08.0414

See Also

boxplot

kmeans_clustersRProg *K-means algorithm applied for different values of clusters*

Description

The som_kmeansR function with 100 epochs training is run for a custom number of times for each k value of clusters and the best of these is selected based on sum of squared errors (err). The Davies-Bouldin index is calculated for each k-clustering. The function has been coded in R code starting from kmeans_clusters.m script present in somtoolbox for Matlab by Vesanto and adapted to show a progress bar when working embedded in the shiny app.

Usage

```
kmeans_clustersRProg(codebook, k = 5, times = 5, seed = NULL)
```

Arguments

codebook	SOM codebook
k	Maximum number of clusters (the function will be run from 2 to k clusters)
times	Number of times the som_kmeansR function is iterated
seed	Number for set.seed function

Value

This function returns a list containing the cluster number assignment for each sample, the cluster centroids, the total quantization error, the DB-index for each number of clusters, and the random seed number used

Author(s)

Sabina Licen, Pierluigi Barbieri

References

J. Vesanto, J. Himberg, E. Alhoniemi, J. Parhankagas, SOM Toolbox for Matlab 5, Report A57, 2000, Available at: www.cis.hut.fi/projects/somtoolbox/package/papers/techrep.pdf

See Also

som_mdistr, som_kmeansRProg, db_indexR

NClusChange	<i>Custom number sequence for clusters</i>
-------------	--

Description

Changes the input vector according the custom number sequence for clusters

Usage

NClusChange(Vector, Centroids, NCh)

Arguments

Vector	Vector containing cluster number assignment for prototypes or experimental data
Centroids	Centroids matrix
NCh	Vector with custom sequence of numbers for clusters

Value

A vector of same length as input vector with cluster numbers changed according to custom input

Author(s)

Sabina Licen

paramQuant	<i>Basic statistics of values present in the input vector</i>
------------	---

Description

Generate basic statistics for the input vector

Usage

paramQuant(param)

Arguments

param	Numeric vector
-------	----------------

Details

The outilers and quartiles are evaluated by boxplot function applying default parameters.

Value

A table which contains basic statistics for the input vector

Author(s)

Sabina Licen

See Also

boxplot

Examples

```
library(datasets)
paramQuant(iris[,1])
```

SomEnvGUI

The function starts the SOMEnv GUI

Description

The function starts the SOMEnv GUI

Usage

```
SomEnvGUI()
```

Value

This function starts the graphical user interface with the default system browser. The main help suggestion for using the tool are embedded in the GUI

Author(s)

Sabina Licen, Marco Franzon, Tommaso Rodani

References

Winston Chang, Joe Cheng, JJ Allaire, Yihui Xie and Jonathan McPherson (2019). shiny: Web Application Framework for R. R package version 1.4.0. <https://CRAN.R-project.org/package=shiny>
seealso shiny

Examples

```
## Not run:
SomEnvGUI()

## End(Not run)
```

`SOMtopol`*Topographical error for the SOM map*

Description

Calculate topographical error for the SOM map

Usage

```
SOMtopol(dataset, codebook, grid)
```

Arguments

<code>dataset</code>	Experimental data used for training the map
<code>codebook</code>	SOM codebook
<code>grid</code>	SOM grid expressed as a matrix of x and y coordinates of the map units

Value

This function returns the topographical error

Author(s)

Sabina Licen

References

Clark, S., Sisson, S.A., Sharma, A. (2020) Adv. Water Resour. 143, art. no. 103676 DOI: 10.1016/j.advwatres.2020.103676

`som_dimR`*Calculate map dimensions*

Description

Generate SOM map dimensions according to Vesanto heuristic rules based on the first two eigenvalues of the experimental data and their related eigenvectors The function has been coded in R code starting from `som_dim.m` script present in `somtoolbox` for Matlab by Vesanto and adapted for the use in the shiny app

Usage

```
som_dimR(dataset, type = "regular")
```

Arguments

dataset	Experimental data
type	Either "regular", "small" or "big" map (default ="regular")

Value

This function returns a list containing the number of rows, columns and overall map units

Author(s)

Sabina Licen, Pierluigi Barbieri

References

J. Vesanto, J. Himberg, E. Alhoniemi, J. Parhankagas, SOM Toolbox for Matlab 5, Report A57, 2000, Available at: www.cis.hut.fi/projects/somtoolbox/package/papers/techrep.pdf

See Also

eigen, cor

Examples

```
library(datasets)
som_dimR(iris[,1:4], type="small")
```

som_initR

Calculate initialization matrix for SOM training

Description

Generate SOM map initialization matrix according to Vesanto heuristic rules related to map dimensions, the first two eigenvalues of the experimental data and their related eigenvectors The function has been coded in R code starting from som_init.m script present in somtoolbox for Matlab by Vesanto and adapted for the use in the shiny app

Usage

```
som_initR(dataset, Row, Col, munits)
```

Arguments

dataset	Experimental data
Row	Number of SOM map rows
Col	Number of SOM map columns
munits	Number of SOM map units (Row*Col)

Value

This function returns an initialization matrix for SOM training

Author(s)

Sabina Licen, Pierluigi Barbieri

References

J. Vesanto, J. Himberg, E. Alhoniemi, J. Parhankagas, SOM Toolbox for Matlab 5, Report A57, 2000, Available at: www.cis.hut.fi/projects/somtoolbox/package/papers/techrep.pdf

Examples

```
SOMdim<-som_dimR(iris[,1:4], type="small")
SOMinit<-som_initR(iris[,1:4],SOMdim$Row,SOMdim$Col,SOMdim$munits)
```

som_kmeansRProg	<i>K-means algorithm applied for a specific number of clusters</i>
-----------------	--

Description

The training is run for a custom number of epochs for k number of clusters

Usage

```
som_kmeansRProg(codebook, k, epochs, seed = NULL)
```

Arguments

codebook	SOM codebook
k	Number of clusters
epochs	Number of training epochs
seed	Number for set.seed function

Details

The function has been coded in R code starting from som_kmeans.m script present in somtoolbox for Matlab by Vesanto and adapted to show a progress bar when working embedded in the shiny app.

Value

This function returns a list containing the cluster number assignment for each sample, the cluster centroids, the total quantization error, and the random seed number used

Author(s)

Sabina Licen, Pierluigi Barbieri

References

J. Vesanto, J. Himberg, E. Alhoniemi, J. Parhankagas, SOM Toolbox for Matlab 5, Report A57, 2000, Available at: www.cis.hut.fi/projects/somtoolbox/package/papers/techrep.pdf

See Also

set.seed

som_mdistr

Evaluate pairwise distance matrix for the given codebook

Description

The function has been coded in R code starting from som_mdistr.m script present in somtoolbox for Matlab by Vesanto and adapted for the use in the shiny app

Usage

```
som_mdistr(codebook)
```

Arguments

codebook SOM codebook

Value

Distance matrix

Author(s)

Sabina Licen, Pierluigi Barbieri

References

J. Vesanto, J. Himberg, E. Alhoniemi, J. Parhankagas, SOM Toolbox for Matlab 5, Report A57, 2000, Available at: www.cis.hut.fi/projects/somtoolbox/package/papers/techrep.pdf

See Also

db_indexR

som_umatR	<i>Unified distance matrix for the SOM map</i>
-----------	--

Description

The function has been coded in R code starting from som_umat.m script present in somtoolbox for Matlab by Vesanto and adapted for the use in the shiny app

Usage

```
som_umatR(codebook, Row, Col)
```

Arguments

codebook	SOM codebook
Row	Number of SOM map rows
Col	Number of SOM map columns

Value

The unified distance matrix for the SOM map

Author(s)

Sabina Licen, Pierluigi Barbieri

References

J. Vesanto, J. Himberg, E. Alhoniemi, J. Parhankagas, SOM Toolbox for Matlab 5, Report A57, 2000, Available at: www.cis.hut.fi/projects/somtoolbox/package/papers/techrep.pdf; A. Ultsch, H.P. Siemon, Proceedings of International Neural Network Conference (INNC'90), Kluwer academic Publishers, Dordrecht, 1990, pp. 305-308.

UmatGraph	<i>U-matrix plot</i>
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Description

Plot of Unified Distance Matrix using a colored scale according to quartiles

Usage

```
UmatGraph(umat, Row, Col, colorscale = c("bw", "gs"))
```

Arguments

umat	Unified Distance Matrix
Row	Number of SOM map rows
Col	Number of SOM map columns
colorscale	Either "bw" for grayscale or "gs" for green-white scale

Details

The function plots a U-matrix map for the values of each modeled variable using a grayscale according to quartiles, from darker color (lower distances) to lighter color (higher distances). The quartiles are evaluated by boxplot function applying default parameters.

Value

Plot of Unified Distance Matrix using a grayscale or (green-white scale) according to quartiles

Author(s)

Sabina Licen

References

J. Vesanto, J. Himberg, E. Alhoniemi, J. Parhankagas, SOM Toolbox for Matlab 5, Report A57, 2000, Available at: www.cis.hut.fi/projects/somtoolbox/package/papers/techrep.pdf; Licen, S., Cozzutto, S., Barbieri, P. (2020) Aerosol Air Qual. Res., 20 (4), pp. 800-809. DOI: 10.4209/aaqr.2019.08.0414

See Also

boxplot, som_umatR

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