Package ‘Radviz’

June 24, 2020

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Suggests knitr, rmarkdown, bodenmiller, tidyR, RColorBrewer, cytofan, scales
LinkingTo Rcpp, RcppArmadillo
Description An implementation of the radviz projection in R. It enables the visualization of multidimensional data while maintaining the relation to the original dimensions. This package provides functions to create and plot radviz projections, and a number of summary plots that enable comparison and analysis. For reference see Ankerst *et al.* (1996) (<http://citeseer.ist.psu.edu/viewdoc/summary?doi=10.1.1.68.1811>) for original implementation, see Di Caro *et al.* (2012) (<http://link.springer.com/chapter/10.1007/978-3-642-13672-6_13>) for the original method for dimensional anchor arrangements, see Demsar *et al.* (2007) (<doi:10.1016/j.jbi.2007.03.010>) for the original Freeviz implementation.
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Author Yann Abraham [aut, cre], Nicolas Sauwen [aut]
Maintainer Yann Abraham <yann.abraham@gmail.com>
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bubbleRadviz

A Plotting Function for the Radviz Object

Description

Plots the Dimensional Anchors and projected data points in a 2D space.

Usage

bubbleRadviz(
  x,
  main = NULL,
  group = NULL,
  color = NULL,
  size = c(3, 16),
  label.color = NULL,
  label.size = NULL,
  bubble.color,
bubbleRadviz

bubble.fg,
bubble.size,
scale,
decreasing,
add
)

Arguments

x a radviz object as produced by do.radviz
main [Optional] a title to the graph, displayed on top
group the name of the grouping variable used to aggregate the data
color [Optional] the name of the variable used to color the points
size the size range for the plot
label.color the color of springs for visualization
label.size the size of labels
bubble.color deprecated, use geom_point instead
bubble.fg deprecated, use geom_point instead
bubble.size deprecated, use geom_point instead
scale deprecated, use geom_point instead
decreasing deprecated, use geom_point instead
add deprecated, use geom_point instead

Details

This function allows for the projection of clusters in Radviz (for example results of the SPADE algorithm), where the cluster size is derived from the number of events that fall into a specific cluster. If color is not specified the grouping variable is used.

Value

the internal ggplot2 object plus added layers, allowing for extra geoms to be added

Author(s)

Yann Abraham

Examples

data(iris)
das <- c('Sepal.Length','Sepal.Width','Petal.Length','Petal.Width')
S <- make.S(das)
rv <- do.radviz(iris,S)
bubbleRadviz(rv, group='Species')
contour.radviz

Plots the Dimensional Anchors and density lines for projected data points in a 2D space.

Description

Plots the Dimensional Anchors and density lines for projected data points in a 2D space.

Usage

```r
## S3 method for class 'radviz'
contour(
  x,
  ..., main = NULL,
  color = NULL,
  size = 0.5,
  label.color = NULL,
  label.size = NULL,
  contour.color,
  contour.size,
  point.color,
  point.shape,
  point.size,
  n,
  drawlabels,
  drawpoints,
  add
)
```

Arguments

- `x`: a radviz object as produced by do.radviz
- `...`: further arguments to be passed to or from other methods (not implemented)
- `main`: [Optional] a title to the graph, displayed on top
- `color`: the variable in the Radviz projection used to color the contours
- `size`: The thickness of contour lines
- `label.color`: the color of springs for visualization
- `label.size`: the size of labels
- `contour.color`: deprecated, see `geom_density2d` instead
- `contour.size`: deprecated, see `geom_density2d` instead
- `point.color`: deprecated, see `geom_density2d` instead
- `point.shape`: deprecated, see `geom_density2d` instead
- `point.size`: deprecated, see `geom_density2d` instead
**cosine**

<table>
<thead>
<tr>
<th>n</th>
<th>deprecated, see <strong>geom_density2d</strong> instead</th>
</tr>
</thead>
<tbody>
<tr>
<td>drawlabels</td>
<td>deprecated, see <strong>geom_density2d</strong> instead</td>
</tr>
<tr>
<td>drawpoints</td>
<td>deprecated, see <strong>geom_density2d</strong> instead</td>
</tr>
<tr>
<td>add</td>
<td>deprecated, see <strong>geom_density2d</strong> instead</td>
</tr>
</tbody>
</table>

**Value**

the internal ggplot2 object plus added layers, allowing for extra geoms to be added

**Author(s)**

Yann Abraham

**Examples**

```r
data(iris)
das <- c('Sepal.Length','Sepal.Width','Petal.Length','Petal.Width')
S <- make.S(das)
rv <- do.radviz(iris,S)
contour(rv,color='Species')
```

---

**cosine**  
*Compute the Cosine Similarity between the Columns of a Data Set*

**Description**

Given a dataset, compute the cosine similarity between to columns for use in optimization of Dimensional Anchors

**Usage**

```r
cosine(mat)
```

**Arguments**

<table>
<thead>
<tr>
<th>mat</th>
<th>A matrix or data.frame</th>
</tr>
</thead>
</table>

**Details**

implementation by David Ruau (see [https://gist.github.com/bobthecat/2903031](https://gist.github.com/bobthecat/2903031) for details)

**Value**

A symmetrical matrix with as many rows as there are columns in input
Author(s)

Yann Abraham
David Ruau

Examples

data(iris)
das <- c('Sepal.Length','Sepal.Width','Petal.Length','Petal.Width')
mat <- iris[,das]
sim.mat <- cosine(mat)
ncol(mat)
dim(sim.mat)

DB_weightedIdx

Computation of weighted version of the Davies-Bouldin index. This index serves as a measure of clustering quality of a 2D projection result with known class labels

Description

Computation of weighted version of the Davies-Bouldin index. This index serves as a measure of clustering quality of a 2D projection result with known class labels

Usage

DB_weightedIdx(x, className = NULL)

Arguments

x an object of class Radviz, as returned by do.radviz
className the name of the class column to use

Details

If className is left NULL (the default) the function expects a single extra column on top of the data columns (used to define springs) and the standard Radviz columns.

Value

weighted DB index value

Author(s)

Nicolas Sauwen
do.L

**Perform L-Normalization on a Vector**

**Description**

Standardizes all values in a vector to the unit vector ([0,1]) using local min and max.

**Usage**

```r
do.L(v, fun = range, na.rm = T)
```

**Arguments**

- `v` a vector of values
- `fun` a function that will return the minimum and maximum values to use to scale `v`; defaults to `range`
- `na.rm` Logical: should NA be removed? defaults to TRUE

**Details**

This is an alternative to performing a L normalization over the full matrix. if the minimum and the maximum values returned after applying `fun` are the same, `do.L` will return 0.

**Value**

A vector of values of the same length as `x`, scaled to the unit vector.

**Example(s)**

Yann Abraham

**Examples**

```r
data(iris)
mat <- iris[,c('Sepal.Length','Sepal.Width','Petal.Length','Petal.Width')]
scaled <- apply(mat,2,do.L)
summary(scaled) # all values are between [0,1]

scaled2 <- apply(mat,2,do.L,fun=function(x) quantile(x,c(0.025,0.975)))
summary(scaled2) # all values are between [0,1]

plot(scaled,scaled2,
     col=rep(seq(1,ncol(scaled)),each=nrow(scaled)),
pch=16)
legend('topleft',legend=dimnames(scaled)[[2]],col=seq(1,ncol(scaled)),pch=16,bty='n')
```
do.optimFreeviz

Optimize the Dimensional Anchors Position using the Freeviz algorithm

Description

Allows to compute the best arrangement of Dimensional Anchors so that visualization efficiency (i.e. separation between classes) is maximized. The Freeviz algorithm is implemented in C++ for optimal computational efficiency.

Usage

```r
do.optimFreeviz(
  x,
  classes,
  attractG = 1,
  repelG = 1,
  law = 0,
  steps = 10,
  springs = NULL,
  multilevel = FALSE,
  nClusters = 5000,
  minTreeLevels = 3,
  subsetting = FALSE,
  minSamples = 1000,
  print = TRUE
)
```

Arguments

- `x` Dataframe or matrix, with observations as rows and attributes as columns
- `classes` Vector with class labels of the observations
- `attractG` Number specifying the weight of the attractive forces
- `repelG` Number specifying the weight of the repulsive forces
- `law` Integer, specifying how forces change with distance: 0 = (inverse) linear, 1 = (inverse) square
- `steps` Number of iterations of the algorithm before re-considering convergence criterion
- `springs` Numeric matrix with initial anchor coordinates. When NULL (=default), springs are initialized by `make.S`
- `multilevel` Logical, indicating whether multi-level computation should be used. Setting it to TRUE can speed up computations
- `nClusters` Number of clusters to be used at coarsest level of hierarchical tree (only used when multilevel is set to TRUE)
**do.optimFreeviz**

- **minTreeLevels**  
  Minimum number of clustering levels to consider (only used when multilevel is set to TRUE). This parameter might over-rule nClusters.

- **subsetting**  
  Logical, indicating whether a subsetting procedure should be used to compute the springs. The subset size is iteratively increased until the springs are found to be close enough to their true values, based on a confidence interval. For large datasets this option can considerably speed up computations.

- **minSamples**  
  Minimum number of samples to be considered for subsetting (only used when subsetting is set to TRUE)

- **print**  
  Logical, indicating whether information on the iterative procedure should be printed in the R console

**Details**

Freeviz is an optimization method that finds the linear projection that best separates instances of different classes, based on a physical metaphor. Observations are considered as physical particles, that exert forces onto each other. Attractive forces occur between observations of the same class, and repulsive forces between observations of different classes, with the force strength depending on the distance between observations. The goal of Freeviz is to find the projection with minimal potential energy. For more details, see the original Freeviz paper: [http://dx.doi.org/10.1016/j.jbi.2007.03.010](http://dx.doi.org/10.1016/j.jbi.2007.03.010)

**Value**

A matrix with 2 columns (x and y coordinates of dimensional anchors) and 1 line per dimensional anchor (so called springs).

**Author(s)**

Nicolas Sauwen

**Examples**

```r
data(iris)
das <- c('Sepal.Length','Sepal.Width','Petal.Length','Petal.Width')
S <- make.S(das)
rv <- do.radviz(iris,S)
plot(rv,anchors.only=FALSE)
new.S <- do.optimFreeviz(x = iris[,das], classes = iris$Species)
new.rv <- do.radviz(iris,new.S)
plot(new.rv,anchors.only=FALSE)
```
do.optimGraphviz

Optimize the Dimensional Anchors Position using the Graphviz algorithm

Description

Allows to compute the best arrangement of Dimensional Anchors so that visualization efficiency (i.e. maintaining graph structure) is optimized. The Graphviz algorithm is implemented in C++ for optimal computational efficiency.

Usage

do.optimGraphviz(
  x,
  graph,
  attractG = 1,
  repelG = 1,
  law = 0,
  steps = 10,
  springs = NULL
)

Arguments

- **x**: a data.frame or matrix to be projected, with column names matching row names in springs
- **graph**: igraph object
- **attractG**: Number specifying the weight of the attractive forces
- **repelG**: Number specifying the weight of the repulsive forces
- **law**: Integer, specifying how forces change with distance: 0 = (inverse) linear, 1 = (inverse) square
- **steps**: Number of iterations of the algorithm before re-considering convergence criterion
- **springs**: Numeric matrix with initial anchor coordinates. When NULL (=default), springs are initialized by `make.S`

Details

Graphviz is a variant of Freeviz (do.optimFreeviz, applicable to a dataset for which a graph structure (i.e. igraph object) is available. Attractive forces are defined between connected nodes in the graph, and repulsive forces between all non-connected nodes. To better maintain the original graph structure after projection, spring constants between connected nodes are proportional to their edge weights. Graphviz can be used as an alternative to Freeviz when class labels are not available.
Value

A matrix with 2 columns (x and y coordinates of dimensional anchors) and 1 line per dimensional anchor (so called springs).

Author(s)

Nicolas Sauwen

Examples

data(iris)
S <- make.S(das)
rv <- do.radviz(iris, S)

plot(rv, anchors.only=FALSE)

## compute distance matrix
d.iris <- dist(iris[, das])

## define a kNN matrix
n.iris <- as.matrix(d.iris)
n.iris <- apply(n.iris, 1, function(x, k=12) {
  x[order(x)>(k+1)] <- 0
  return(x)
})
diag(n.iris) <- 0

## compute weights for kNN matrix
w.iris <- n.iris
w.iris <- exp(-w.iris^2/(2*median(w.iris[w.iris!=0])^2))
w.iris[n.iris==0] <- 0

## create graph
library(igraph)
g.iris <- graph.adjacency(w.iris, mode='undirected', weight=TRUE, diag=FALSE)
V(g.iris)$Species <- as.character(iris[, 'Species'])
V(g.iris)$color <- as.numeric(iris[, 'Species'])

plot(g.iris, vertex.label=NA)

## project using Radviz
new.S <- do.optimGraphviz(iris[, das], g.iris)
grv <- do.radviz(iris[, das],
  new.S,
  graph=g.iris)

library(ggplot2)
do.optimRadviz

Optimize the Dimensional Anchors Position for Radviz projection using a Genetic Algorithm

Description

Allows to compute the best arrangement of Dimensional Anchors so that visualization efficiency is maximized.

Usage

```r
do.optimRadviz(
  springs, similarity, iter = 100, n = 1000, top = round(n * 0.1), lambda = 0.01, nlast = 5, optim = "in.da"
)
```

do.optim(
  springs, similarity, iter = 100, n = 1000, top = round(n * 0.1), lambda = 0.01, nlast = 5, optim = "in.da"
)

Arguments

- **springs**: A matrix of 2D dimensional anchor coordinates, as returned by `make.S`
- **similarity**: A similarity matrix measuring the correlation between Dimensional Anchors
- **iter**: The maximum number of iterations (defaults to 100)
- **n**: The number of permutations of Dimensional Anchors to be created at each generation
- **top**: The number of permutations to keep to create the next generation
- **lambda**: The threshold for the optimization process
- **nlast**: The number of generations to wait before lambda is applied
- **optim**: The optimization function (in or rv)
Details

The first generation is a random sampling of all Dimensional Anchors. For every generation afterwards, only the best solutions (as specified by top) are kept; the solutions are normalized around the unit circle (ie c(1,2,3,4) is equivalent to c(4,1,2,3) for Radviz projection) before the next generation is created. The next generation consists of

- all unique best solutions from the previous generation (after circular normalization)
- a permutation of all previous solutions.

Briefly, for every Dimensional Anchor position the previous generation is sampled to give a mixture of identical and slightly shifted (mutated) solutions. The algorithm will stop when the maximum number of iterations (as defined by \( \text{iter} \)) is reached, or when a number of generations (defined by \( \text{nlast} \)) as not improved over the best solution by more than a given threshold (specified by \( \lambda \)).

Value

a list containing 3 sets of values:

- \( \text{perfs} \) the list of the best performances by generation
- \( \text{best} \) the best performing arrangement by generation
- \( \text{last} \) the top performing arrangements of the last generation

Examples

data(iris)
das <- c('Sepal.Length','Sepal.Width','Petal.Length','Petal.Width')
S <- make.S(das)
rv <- do.radviz(iris,S)
plot(rv,anchors.only=FALSE)
sim.mat <- cosine(iris[,das])
in.da(S,sim.mat) # the starting value
new <- do.optimRadviz(S,sim.mat,iter=10,n=100)
new.S <- make.S(get.optim(new))
new.rv <- do.radviz(iris,new.S)
plot(new.rv,anchors.only=FALSE)
do.radviz

Projects a Matrix or a Data Frame to a 2D space defined by Dimensional Anchors

Description

do.radviz will return a projection of a multidimensional dataset onto a 2D space defined by dimensional anchors that have been projected on the unit circle using make.S

Usage

do.radviz(
  x,
  springs,
  trans = do.L,
  label.color = "orangered4",
  label.size = NA,
  type = NULL,
  graph = NULL
)

Arguments

x a data.frame or matrix to be projected, with column names matching row names in springs

springs a matrix of 2D dimensional anchor coordinates, as returned by make.S

trans a transformation to be applied to the data before projection

label.color the color of springs for visualization

label.size the size of labels

type character string specifying the method used for obtaining the springs. Current methods are: Radviz, Freeviz and Graphviz. When not provided, type is derived from the other inputs

graph igraph object (only relevant for result obtained from do.optimGraphviz analysis)

Details

The function expects that at least some of the column names in df will be matched by row names in springs

Value

an object of class radviz with the following slots:

- proj a ggplot2 object with a single geom_text layer corresponding to springs. the data slot of the ggplot2 corresponds to the input parameter x with the following extra columns:
get.optim

- rx and ry the X and Y coordinates of the radviz projection of x over springs
- rvalid an index of points corresponding to an invalid projection (any rx or ry is NA)

• type: character string specifying the method used for obtaining the springs.
• trans: the function used to transform the data.
• graphEdges: when the input graph is provided (for a Graphviz analysis), this slot will contain a dataframe with the graph edges

Author(s)
Yann Abraham

Examples

data(iris)
S <- make.S(das)
rv <- do.radviz(iris, S)
summary(rv)

data(iris)
iris0 <- rbind(iris, c(rep(0, length(das)), NA))
S <- make.S(das)
rv0 <- do.radviz(iris0, S)

sum(!is.valid(rv0)) # should be 1

# to find which points where invalid in the data
which(!is.valid(rv0))

# to review the original data points
rv1 <- subset(rv0, is.valid(rv0))

summary(rv1)

get.optim

Get the Result of the Optimization Operation

Description
Once the order of anchors has been optimized using do.optimRadviz this function can be used to recover the optimized anchors or any intermediate step

Usage
get.optim(opt, n = NULL)
Arguments

opt the result of the optimization operation performed by `do.optimRadviz`

n the optimized order of anchors to return; defaults to NULL, which returns the best identified combination

Value

a character vector of the anchor names, ordered as in the n\textsuperscript{th} step of the optimization

Author(s)

Yann Abraham

Examples

data(iris)
S <- make.S(das)
sim.mat <- cosine(iris[,das])
in.da(S,sim.mat) # the starting value
new <- do.optimRadviz(S,sim.mat,iter=10,n=100)
get.optim(new) # the optimal order
get.optim(new,2) # the second step of the optimization

hexplot A hexplot function for Radviz objects

Description

Plots the Dimensional Anchors and a hexplot-based density representation of projected data points in a 2D space.

Usage

hexplot(
x,
main = NULL,
bins = 30,
color = NULL,
label.color = NULL,
label.size = NULL,
mincnt,
style
)
Arguments

x a radviz object as produced by do.radviz
main [Optional] a title to the graph, displayed on top
nbins the number of equally spaced bins for the binning computation (see geom_hex for details)
color if color is not NULL and corresponds to one of the channels in the hexcols slot of the Radviz object, cells will be colored using colors in the hexcols slot
label.color the color of springs for visualization
label.size the size of labels
mincnt deprecated, see stat_summary_hex instead
style deprecated, see stat_summary_hex instead

Value

the internal ggplot2 object plus added layers, allowing for extra geoms to be added

Author(s)

Yann Abraham

Examples

data(iris)
S <- make.S(das)
rv <- do.radviz(iris, S)
hexplot(rv, color='Sepal.Length')

in.da Optimization functions for Dimensional Anchors in Radviz

Description

Visual efficiency of Radviz plots depends heavily on the correct arrangement of Dimensional Anchors. These functions implement the optimization strategies described in Di Caro et al 2012

Usage

in.da(springs, similarity)
rv.da(springs, similarity)

Arguments

springs A matrix of 2D dimensional anchor coordinates, as returned by make.S
similarity A similarity matrix measuring the correlation between Dimensional Anchors
Details

Following the recommendation of Di Caro *et al.* we used a cosine function to calculate the similarity between Dimensional Anchors (see `cosine` for details). The `in.da` function implements the independent similarity measure, where the value increases as the Radviz projection improves. The `rv.da` function implements the radviz-dependent similarity measure, where the value decreases as the Radviz projection improves.

Value

A measure of the efficiency of the Radviz projection of the similarity matrix onto a set of springs

Author(s)

Yann Abraham

Examples

data(iris)
das <- c('Sepal.Length','Sepal.Width','Petal.Length','Petal.Width')
S <- make.S(das)
mat <- iris[,das]
sim.mat <- cosine(mat)
in.da(S,sim.mat)
rv.da(S,sim.mat)

---

**is.radviz**

Test if the object is a Radviz object

Description

The function will return TRUE if the object is a Radviz object

Usage

`is.radviz(x)`

Arguments

- `x` an object of class Radviz, as returned by `do.radviz`

Author(s)

Yann Abraham
is.valid

Examples
data(iris)
das <- c('Sepal.Length','Sepal.Width','Petal.Length','Petal.Width')
S <- make.S(das)
rv <- do.radviz(iris,S)
is.radviz(rv) # should be true

is.valid

Identify the valid projections from a Radviz object

Description
The function will return a vector as long as the data in x where points that could not be projected are TRUE.

Usage
is.valid(x)

Arguments
x an object of class Radviz, as returned by do.radviz

Author(s)
Yann Abraham

Examples
data(iris)
das <- c('Sepal.Length','Sepal.Width','Petal.Length','Petal.Width')
iris0 <- rbind(iris,c(rep(0,length(das)),NA))
S <- make.S(das)
rv0 <- do.radviz(iris0,S)

sum(!is.valid(rv0)) # should be 1

# to find which points where invalid in the data which(!is.valid(rv0))

# to review the original data points
rv1 <- subset(rv0,is.valid(rv0))

summary(rv1)
**make.S**

*Define Dimensional Anchors around the Unit Circle*

**Description**

make.S will return \([x,y]\) coordinates for \(n\) dimensional anchors equally spaced around the unit circle.

**Usage**

```r
make.S(x)
```

**Arguments**

- **x**: a vector of dimensional anchors, or a list of dimensional anchors for Class Discrimination Layout, or the number of anchors to put on the circle.

**Details**

If \(x\) is a vector or a list, values will be used to set the row names of the matrix.

**Value**

A matrix with 2 columns (\(x\) and \(y\) coordinates of dimensional anchors) and 1 line per dimensional anchor (so called springs). If \(x\) is a vector, the row names of the matrix will be set to the syntactically correct version of values in the vector (through a call to `make.names`). Please note that some functions expect to match column names of data to row names of the spring matrix.

**Author(s)**

Yann Abraham

**Examples**

```r
data(iris)
das <- c('Sepal.Length','Sepal.Width','Petal.Length','Petal.Width')
make.S(length(das)) # without row names
make.S(das) # with row names
make.S(list(c('Sepal.Length','Sepal.Width'),c('Petal.Length','Petal.Width')))
```
plot.radviz  

A Plotting Function for the Radviz Object  

Description

Plots the Dimensional Anchors and projected data points in a 2D space.

Usage

```r
## S3 method for class 'radviz'
plot(
  x, 
  main = NULL, 
  anchors.only = TRUE, 
  anchors.filter = NULL, 
  label.color = NULL, 
  label.size = NULL, 
  point.color, 
  point.shape, 
  point.size, 
  add, 
  ...
)
```

Arguments

- `x`: a radviz object as produced by `do.radviz`
- `main`: [Optional] a title to the graph, displayed on top
- `anchors.only`: by default only plot the anchors so that other methods can easily be chained
- `anchors.filter`: filter out anchors with low contributions to the projection
- `label.color`: the color of springs for visualization
- `label.size`: the size of labels
- `point.color`: deprecated, use `geom_point` instead
- `point.shape`: deprecated, use `geom_point` instead
- `point.size`: deprecated, use `geom_point` instead
- `add`: deprecated, use `geom_point` instead
- `...`: further arguments to be passed to or from other methods (not implemented)

Details

by default the plot function only shows the anchors. Extra geoms are required to display the data. When `anchors.filter` is a number and type is not Radviz, any springs whose length is lower than this number will be filtered out of the visualization. This has no effect on the projection itself.
Value

the internal ggplot2 object, allowing for extra geoms to be added

Author(s)

Yann Abraham

Examples

data(iris)
das <- c('Sepal.Length','Sepal.Width','Petal.Length','Petal.Width')
S <- make.S(das)
rv <- do.radviz(iris,S)
plot(rv)
plot(rv,anchors.only=FALSE)

library(ggplot2)
## should look the same as before
plot(rv)+geom_point()
plot(rv)+geom_point(aes(color=Species))

---

Radviz

Radviz Projection of Multidimensional Data

Description

Radviz uses Dimensional Anchors and the spring paradigm to project a multidimensional space in 2D. This allows for the quick visualization of large and complex datasets.

Examples

data(iris)
das <- c('Sepal.Length','Sepal.Width','Petal.Length','Petal.Width')
S <- make.S(das)
rv <- do.radviz(iris,S)
plot(rv,anchors.only=FALSE)
**recenter**  
*Rotate Dimensional Anchors around the Unit Circle*

**Description**
recenter will rotate the order of the dimensional anchors around the circle, to put a channel of reference to the top of the display.

**Usage**
recenter(springs, newc)

**Arguments**
- `springs` a spring object as created by `make.S`
- `newc` a string specifying which dimensional anchor should be placed on top of the unit circle

**Value**
a spring object with rotated labels

**Author(s)**
Yann Abraham

**Examples**
```r
data(iris)
das <- c('Sepal.Length','Sepal.Width','Petal.Length','Petal.Width')
iris.S <- make.S(das)
iris.S
recenter(iris.S,'Petal.Length')```

---

**rescalePlot**  
*Rescaling of projected data for plotting*

**Description**
Rescaling of projected data for plotting

**Usage**
rescalePlot(x, fraction = 0.9)
smoothRadviz

Arguments

x
a radviz object as produced by do.radviz

fraction
numeric value, indicating which fraction of the unit circle should be used for the rescaled plot

Details

A different rescaling is used here for plotting the projected data as compared to do.radviz. Only feature-wise rescaling is applied to the original data (through do.L), in accordance with the rescaling used in do.optimFreeviz and do.optimGraphviz. The projected data is then rescaled based on amplitude, to cover a pre-specified fraction of the unit circle. For Freeviz and Graphviz objects, the rescaling will issue a warning if some points extend beyond the some anchors: in that case only the direction of the anchor can be interpreted but not the magnitude represented by the anchor's position.

Value

a radviz object as produced by do.radviz

Author(s)

Nicolas Sauwen

Examples

data(iris)
das <- c('Sepal.Length','Sepal.Width','Petal.Length','Petal.Width')
S <- make.S(das)
rv <- do.radviz(iris,S)
library(ggplot2)
plot(rv)+geom_point(aes(color=Species))
new.rv <- rescalePlot(rv)
plot(new.rv)+geom_point(aes(color=Species))

smoothRadviz

A smoothScatter function for Radviz objects

Description

Plots the Dimensional Anchors and a smoothed color density representation of projected data points in a 2D space.
smoothRadviz

Usage

smoothRadviz(
x,  
main = NULL,  
color = "dodgerblue4",  
nbin = 200,  
label.color = NULL,  
label.size = NULL,  
smooth.color,  
max.dens,  
transformation,  
npoints,  
ncols,  
bandwidth
)

Arguments

x a radviz object as produced by do.radviz
main [Optional] a title to the graph, displayed on top
color the gradient will be generated from white to color
nbin the number of equally spaced grid points for the density estimation (see geom_density_2d for details)
label.color the color of springs for visualization
label.size the size of labels
smooth.color deprecated, see stat_density2d instead
max.dens deprecated, see stat_density2d instead
transformation deprecated, see stat_density2d instead
npoints deprecated, see stat_density2d instead
ncols deprecated, see stat_density2d instead
bandwidth deprecated, see stat_density2d instead

Value

the internal ggplot2 object plus added layers, allowing for extra geoms to be added

Author(s)

Yann Abraham

Examples

data(iris)
das <- c("Sepal.Length","Sepal.Width","Petal.Length","Petal.Width")
S <- make.S(das)
rv <- do.radviz(iris,S)
smoothRadviz(rv)

subset.radviz Subsetting a Radviz projection

Description
Subsetting a Radviz projection

Usage
## S3 method for class 'radviz'
subset(x, i = TRUE, ...)

Arguments
x
a radviz object

i
A logical vector or expression evaluated on the Radviz object

... further arguments to be passed to or from other methods (not implemented)

Value
a new Radviz object containing only rows specified in i

Author(s)
Yann Abraham

Examples
data(iris)
S <- make.S(das)
rv <- do.radviz(iris,S)
# subset rv
srv <- subset(rv,iris$Species=='setosa')
summary(srv)
sum(iris$Species=='setosa') # 50 objects in srv corresponding to setosa values
summary.radviz

**Radviz Object Summary, head, print, dim and springs Methods**

**Description**

Provides a summary for Radviz objects.

**Usage**

```r
## S3 method for class 'radviz'
summary(object, ..., n = 6)

## S3 method for class 'radviz'
head(x, n = 6, ...)

## S3 method for class 'radviz'
dim(x)

## S3 method for class 'radviz'
print(x, ...)

springs(x)
```

**Arguments**

- **object**
  - an object of class Radviz, as returned by `do.radviz`
- **...**
  - further arguments to be passed to or from other methods (not implemented)
- **n**
  - the number of lines from each slots in the Radviz object to display (defaults to 6)
- **x**
  - an object of class Radviz, as returned by `do.radviz`

**Details**

dim returns the number of points and the number of dimensions used for the projection

**Author(s)**

Yann Abraham

**Examples**

```r
data(iris)
das <- c('Sepal.Length','Sepal.Width','Petal.Length','Petal.Width')
S <- make.S(das)
rv <- do.radviz(iris,S)
summary(rv)
```
head(rv)
dim(rv)
print(rv)

---

**text.radviz**

*Text annotations for the Radviz Plots*

### Description

Text draws the strings given in the vector labels at the coordinates given by the radviz projection.

### Usage

```r
## S3 method for class 'radviz'
text(
  x,
  ...,  # further arguments to be passed to or from other methods (not implemented)
  main = NULL,
  labels = NULL,
  size = FALSE,
  label.color = NULL,
  label.size = NULL,
  adj = 0,
  pos = 0,
  offset = 0,
  vfont = "plain",
  cex = 0.2,
  col = "black",
  font = TRUE,
  add = TRUE
)
```

### Arguments

- **x**
  - a radviz object as produced by do.radviz

- **...**
  - further arguments to be passed to or from other methods (not implemented)

- **main**
  - [Optional] a title to the graph, displayed on top if add is TRUE

- **labels**
  - the name of the variable used for labeling (see details)

- **size**
  - [Logical] if TRUE labels are sized after the number of points they correspond to

- **label.color**
  - deprecated, see `do.radviz`

- **label.size**
  - deprecated, see `do.radviz`

- **adj**
  - deprecated, see `geom_text` instead

- **pos**
  - deprecated, see `geom_text` instead

- **offset**
  - deprecated, see `geom_text` instead
theme_radviz

vfont  deprecated, see `geom_text` instead
cex  deprecated, see `geom_text` instead
col  deprecated, see `geom_text` instead
font  deprecated, see `geom_text` instead
add  deprecated, see `geom_text` instead

Author(s)
Yann Abraham

Examples

```r
data(iris)
das <- c('Sepal.Length','Sepal.Width','Petal.Length','Petal.Width')
S <- make.S(das)
rv <- do.radviz(iris,S)
text(rv,labels='Species')
```

theme_radviz  Complete ggplot2 theme for Radviz projections

Description
A complete Radviz theme based on `ggplot2::theme_light`

Usage

```r
theme_radviz(
  base_size = 11,
  base_family = "",
  base_line_size = base_size/22,
  base_rect_size = base_size/22
)
```

Arguments

- `base_size`  base font size
- `base_family`  base font family
- `base_line_size`  base size for line elements
- `base_rect_size`  base size for rect elements

Details
On top of `ggplot2::theme_light` this theme removes axis title, text and ticks, as well as the reference grid. See `theme` for details.
tuneForceRatio

Method to compute optimal ratio between repulsive and attractive forces for Freeviz.

Description

Method to compute optimal ratio between repulsive and attractive forces for Freeviz.

Usage

tuneForceRatio(
  x,
  classes,
  law = 0,
  steps = 10,
  springs = NULL,
  multilevel = TRUE,
  print = TRUE
)

Arguments

x Dataframe or matrix, with observations as rows and attributes as columns
classes Vector with class labels of the observations
law Integer, specifying how forces change with distance: 0 = (inverse) linear, 1 = (inverse) square
steps Number of iterations of the algorithm before re-considering convergence criterion
tuneForceRatio

springs  Numeric matrix with initial anchor coordinates. When NULL (=default), springs are initialized by `make.S`
multilevel  Logical, indicating whether multi-level computation should be used. Setting it to TRUE can speed up computations
print  Logical, indicating whether information on the iterative procedure should be printed in the R console

Details

Running Freeviz, it is hard to know what weights to specify for the attractive and repulsive forces to optimize the projection result. This function runs an iterative procedure to find the optimal force ratio. First, a logarithmic grid search is performed, followed by 1D optimization on the refined interval. This approach is less prone to getting stuck in a suboptimal local optimum, and requires less Freeviz evaluations than direct 1D optimization

Value

Value of the optimal force ratio (attractive force in the nominator)

Author(s)

Nicolas Sauwen

Examples

data(iris)
das <- c('Sepal.Length','Sepal.Width','Petal.Length','Petal.Width')
S <- make.S(das)
rv <- do.radviz(iris,S)
plot(rv,anchors.only=FALSE)
forceRatio <- tuneForceRatio(x = iris[,das], classes = iris$Species)
new.S <- do.optimFreeviz(x = iris[,das], classes = iris$Species, attractG = forceRatio, repelG = 1)
new.rv <- do.radviz(iris,new.S)
plot(new.rv,anchors.only=FALSE)
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