Package ‘Prize’

April 26, 2017

Type Package
Title Prize: an R package for prioritization estimation based on analytic hierarchy process
Version 1.6.0
Date 2016-12-13
Author Daryanaz Dargahi <daryanazdargahi@gmail.com>
Maintainer Daryanaz Dargahi <daryanazdargahi@gmail.com>
Description The high throughput studies often produce large amounts of numerous genes and proteins of interest. While it is difficult to study and validate all of them. Analytic Hierarchy Process (AHP) offers a novel approach to narrowing down long lists of candidates by prioritizing them based on how well they meet the research goal. AHP is a mathematical technique for organizing and analyzing complex decisions where multiple criteria are involved. The technique structures problems into a hierarchy of elements, and helps to specify numerical weights representing the relative importance of each element. Numerical weight or priority derived from each element allows users to find alternatives that best suit their goal and their understanding of the problem.
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Imports diagram, stringr, ggplot2, reshape2, grDevices, matrixcalc, stats, gplots, methods, utils, graphics
Suggests RUnit, BiocGenerics
biocViews Software, MultipleComparison, GeneExpression, CellBiology, RNASeq
NeedsCompilation no

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Prize-package

Prize-package

Prize: an R package for prioritization estimation based on analytic hierarchy process

Description

The Prize package is a decision analysis tool based on Analytic Hierarchy Process (AHP), which provides a logical framework to rank and prioritize a group of alternatives. Once the decision makers have their list of available options (alternatives) and defined their criteria for prioritization, the Prize package allows aggregation of individual judgements against each criterion into a group judgement, then use these judgements to calculate final ahp weight for ranking. The Prize package also provides visualization tools to illustrate the problem hierarchy, the criteria weights and final ranking.

Author(s)

Daryanaz Dargahi <daryanazdargahi@gmail.com>

References


Examples

########################################################################
## aggregation of individual opinions
########################################################################
mat = matrix(nrow = 4, ncol = 1, data = NA)
mat[,1] = c(system.file("extdata","ind1.tsv",package = 'Prize'),
                  system.file("extdata","ind2.tsv",package = 'Prize'),
                  system.file("extdata","ind3.tsv",package = 'Prize'),
                  system.file("extdata","ind4.tsv",package = 'Prize'))
rownames(mat) = c('ind1','ind2','ind3', 'ind4')
colnames(mat) = c('individual_judgement')

# non-weighted AIJ
res = gaggregate(srcfile = mat, method = 'geometric', simulation = 500)
########################################################################
## Estimating idealised prioritise
## Rating AHP
########################################################################
category_pcm = read.delim(system.file("extdata","number.tsv", package = 'Prize')
                  , sep = '	', header = TRUE, row.names = 1)
alt_mat = read.delim(system.file("extdata","numEpitope_alternative_category.tsv",
                , sep = '	', header = TRUE, row.names = 1))
Aggreg.Judgement includes a PCM computed from aggregation of decision makers opinions. The PCM includes 4 criteria to prioritize a set of genes of interest according to their potential to serve as a tumor marker/therapeutic target. The criteria include: Tumor_expression, Normal_expression, Frequency, and Epitopes.
Description

Converting a triangular matrix into a square pairwise comparison matrix (PCM) where the diagonal values are equal to 1 and $a[i,j] = 1/a[j,i]$.

Usage

```
ahmatrix(x)
```

Arguments

- `x` a numeric triangular matrix, where empty elements are specified with NA.

Value

An S4 object including a PCM.

Author(s)

Daryanaz Dargahi

Examples

```
mat <- matrix(nrow = 3, ncol = 3, data = NA)
mat[1,2] <- 5
mat[1,3] <- 2
mat[2,3] <- 7
res <- ahmatrix(mat)
```
ahmatrixObj-class  Class ahmatrixObj

Description
An object that stores a pairwise comparison matrix.

Objects from the Class
Objects can be created by calls of the form new("ahmatrixObj", ...).

Slots
ahp_matrix: A pairwise comparison matrix.

Author(s)
Daryanaz Dargahi <daryanazdargahi@gmail.com>

ahp

Description
Computing AHP weights as well as Satty’s inconsistency.

Usage
ahp(x, simulation = 500)

Arguments
x a pairwise comparison matrix (PCM) with diagonal values equal 1 and a[i,j] = 1/a[j,i].
simulation the simulation size in order to compute Satty’s inconsistency. The default value is 500.

Value
An S4 object including a numeric vector of AHP weights and Satty’s inconsistency.

Author(s)
Daryanaz Dargahi

References
Examples

```r
mat <- matrix(c(1,2,5, 1/2,1,3, 1/5,1/3,1), nrow = 3, ncol = 3, byrow = TRUE)
res <- ahp(mat, simulation = 500)
```

Description

Plotting the problem hierarchy, showing the relationships between goal, criteria, and subcriteria.

Usage

```r
ahplot(srcfile, fontsize = 0.5, cradx = 0.07, crady = 0.05,
sradx = 0.05, srady = 0.05, cirx = 0.1, ciry = 0.05, gcol = "green",
ccol = "yellow", scol = "orange", lcol = "black", dist = 0.05,
digit = 3, main = NULL)
```

Arguments

- `srcfile`: a character matrix, where the first column specifies the hierarchy order. The second and third columns include the ID of decision elements and AHP weights (optional), respectively (See the example below).
- `fontsize`: the font size of characters.
- `cradx, crady`: the horizontal and vertical radius of the criteria box, respectively.
- `sradx, srady`: the horizontal and vertical radius of the subcriteria box, respectively.
- `cirx, ciry`: the horizontal and vertical radius of the goal
- `gcol, ccol, scol`: the filling color of the goal, criteria, and subcriteria boxes, respectively.
- `lcol`: the line color surrounding the goal, criteria, and subcriteria boxes.
- `dist`: the distance between the weights and the tree edges.
- `digit`: the number of digits after decimal point to be shown on the arrows.
- `main`: a character string as the plot title

Value

An object created by ‘diagram’.

Author(s)

Daryanaz Dargahi
Examples

mat <- matrix(nrow = 7, ncol = 2, data = NA)
mat[,1] <- c('8', '9', '10', '11', '12', '13', '14')

# plotting a problem hierarchy
ahplot(mat, fontsize = 0.7, cradx = 0.11, sradx = 0.12, cirx = 0.18, ciry = 0.07)

# plotting a problem hierarchy with AHP weights shown on the edges of the graph
mat <- cbind(mat, c(1, 0.470, 0.341, 0.117, 0.073, 0.009, 0.064))
ahplot(mat, fontsize = 0.7, cradx = 0.11, sradx = 0.12, cirx = 0.18, ciry = 0.07)

ahpObj-class

Class ahpObj

Description

An object that stores AHP priorities and consistency ratio.

Objects from the Class

Objects can be created by calls of the form new("ahpObj", ...).

Slots

weight: A vector of AHP priorities.
saaty_inconsistency: The consistency ratio.

Author(s)

Daryanaz Dargahi <daryanazdargahi@gmail.com>

ahp_matrix

AHP matrix slot

Description

ahp_matrix is a slot of ahmatrixObj class. It consists of a square pairwise comparison matrix.

Author(s)

Daryanaz Dargahi <daryanazdargahi@gmail.com>

Examples

mat <- matrix(nrow = 3, ncol = 3, data = NA)
mat[1,2] <- 5
mat[1,3] <- 2
mat[2,3] <- 7
res <- ahmatrix(mat)
ahp_matrix(res)
**ahp_plot**

**AHP plot slot**

**Description**

ahp_plot is a slot of pipelineObj class. It consists of a matrix of problem hierarchy.

**Author(s)**

Daryanaz Dargahi <daryanazdargahi@gmail.com>

**Examples**

```r
mat <- matrix(nrow = 7, ncol = 3, data = NA)
mat[,]1 <- c('0', '1', '2', '3', '4', '4.1', '4.2')
mat[,]2 <- c('Prioritization_of_DE_genes', 'Tumor_expression', 'Normal_expression', 
            'Frequency', 'Epitopes', 'Number_of_epitopes', 'Size_of_epitopes')
mat[,]3 <- c(system.file('extdata', 'aggreg.judgement.tsv', package = 'Prize'),
            system.file('extdata', 'tumor.PCM.tsv', package = 'Prize'),
            system.file('extdata', 'normal.PCM.tsv', package = 'Prize'),
            system.file('extdata', 'freq.PCM.tsv', package = 'Prize'),
            system.file('extdata', 'epitope.PCM.tsv', package = 'Prize'),
            system.file('extdata', 'epitopeNum.PCM.tsv', package = 'Prize'),
            system.file('extdata', 'epitopeLength.PCM.tsv', package = 'Prize'))

result <- pipeline(mat, model = 'relative', simulation = 500)
ahp_plot(result)
```

---

**ahp_weights**

**AHP weights slot**

**Description**

ahp_weights is a slot of pipelineObj class. It consists of a list of matrices representing AHP priorities for all decision elements

**Author(s)**

Daryanaz Dargahi <daryanazdargahi@gmail.com>

**Examples**

```r
mat <- matrix(nrow = 7, ncol = 3, data = NA)
mat[,]1 <- c('0', '1', '2', '3', '4', '4.1', '4.2')
mat[,]2 <- c('Prioritization_of_DE_genes', 'Tumor_expression', 'Normal_expression', 
            'Frequency', 'Epitopes', 'Number_of_epitopes', 'Size_of_epitopes')
mat[,]3 <- c(system.file('extdata', 'aggreg.judgement.tsv', package = 'Prize'),
            system.file('extdata', 'tumor.PCM.tsv', package = 'Prize'),
            system.file('extdata', 'normal.PCM.tsv', package = 'Prize'),
            system.file('extdata', 'freq.PCM.tsv', package = 'Prize'),
            system.file('extdata', 'epitope.PCM.tsv', package = 'Prize'),
            system.file('extdata', 'epitopeNum.PCM.tsv', package = 'Prize'),
            system.file('extdata', 'epitopeLength.PCM.tsv', package = 'Prize'),
```
AIJ

Aggregated individual judgements (AIJ) slot

Description

AIJ (Aggregated individual judgements) is a slot of geoAggreg class. It consists of a matrix of aggregated group judgements (a pairwise comparison matrix).

Author(s)

Daryanaz Dargahi <daryanazdargahi@gmail.com>

Examples

```r
mat <- matrix(nrow = 4, ncol = 1, data = NA)
mat[,1] <- c(system.file('extdata','ind1.tsv',package = 'Prize'),
            system.file('extdata','ind2.tsv',package = 'Prize'),
            system.file('extdata','ind3.tsv',package = 'Prize'),
            system.file('extdata','ind4.tsv',package = 'Prize'))
rownames(mat) <- c('ind1','ind2','ind3','ind4')
colnames(mat) <- c('individual_judgement')

# non-weighted aggregation
res <- gaggregate(srcfile = mat, method = 'geometric', simulation = 500)
AIJ(res)
```

AIP

Aggregated individual priorities (AIP) slot

Description

AIP (Aggregated individual priorities) is a slot of ariAggreg class. It consists of a vector of aggregated group priorities.

Author(s)

Daryanaz Dargahi <daryanazdargahi@gmail.com>
Examples

mat <- matrix(nrow = 4, ncol = 1, data = NA)
mat[,1] <- c(system.file('extdata','ind1.tsv',package = 'Prize'),
            system.file('extdata','ind2.tsv',package = 'Prize'),
            system.file('extdata','ind3.tsv',package = 'Prize'),
            system.file('extdata','ind4.tsv',package = 'Prize'))
rownames(mat) <- c('ind1','ind2','ind3','ind4')
colnames(mat) <- c('individual_judgement')

# non-weighted aggregation
res <- gaggregate(srcfile = mat, method = 'arithmetic', simulation = 500)
AIP(res)

ariAggreg-class

Class ariAggreg

Description
An object that stores the aggregated group priorities as well as consistency ratio of the individual judgements.

Objects from the Class
Objects can be created by calls of the form new("ariAggreg", ...).

Slots
AIP: A vector of aggregated group priorities.
ICR: A vector of individuals judgements consistency ratio.
IP: A matrix of individual and aggregated group AHP priorities.

Author(s)
Daryanaz Dargahi <daryanazdargahi@gmail.com>

CI

Consistency index (CI) slot

Description
CI (Consistency index) is a slot of geoAggreg class. It consists of a vector of the individuals consistency index.

Author(s)
Daryanaz Dargahi <daryanazdargahi@gmail.com>
Examples

```r
mat <- matrix(nrow = 4, ncol = 1, data = NA)
mattr[,1] <- c(system.file("extdata",'ind1.tsv',package = "Prize"),
  system.file("extdata",'ind2.tsv',package = "Prize"),
  system.file("extdata",'ind3.tsv',package = "Prize"),
  system.file("extdata",'ind4.tsv',package = "Prize"))
rownames(mat) <- c('ind1','ind2','ind3','ind4')
colnames(mat) <- c('individual_judgement')

# non-weighted aggregation
res <- gaggregate(srcfile = mat, method = 'geometric', simulation = 500)
CI(res)
```

**Description**

Plotting the consistency ratio (CR) of individual judgements. According to Satty, a pairwise comparison matrix is considered to be consistent if CR is equal or less than 0.1. Therefore, CRs equal to or less than 0.1 are colored in green (Pass) and CRs greater than 0.1 are colored in red (Failed).

**Usage**

```r
crplot(srcfile, fontsize = 15, xcex = 10, ycex = 10, angle = 90,
  xlab = "ID", ylab = "ICR", main = NULL)
```

**Arguments**

- `srcfile` a numeric vector of individual CR
- `fontsize` the font size of plot title, x and y axis labels. The default value is 15.
- `xcex,ycex` the font size of x and y axis, respectively. The default values is 10.
- `angle` the angle of the labels on x axis
- `xlab,ylab` the label to be shown on the x and y axis, respectively.
- `main` the plot title

**Value**

An object created by 'ggplot'.

**Author(s)**

Daryanaz Dargahi

**Examples**

```r
data <- c(0.1132, 0.0142, 0.0324, 0.10075, 0.0883)
names(data) <- c('individual_1','individual_2','individual_3','individual_4','individual_5')
crplot(data, fontsize = 15, xcex = 10, ycex = 10, xlab = 'ID', ylab = 'ICR', main = 'Individuals consistency ratio')
```
**Description**

Computing and plotting the distance between individuals and group judgement. Distances are computed using classical multidimensional scaling (MDS) approach.

**Usage**

```r
dplot(srcfile, fontsize = 15, xcex = 10, ycex = 10, lcex = 5, hjust = 0.5, vjust = 1, xlab = "Coordinate 1", ylab = "Coordinate 2", main = NULL)
```

**Arguments**

- `srcfile`: a numeric matrix of individual and group priorities.
- `fontsize`: the font size of the plot title, and x and y axis labels. The default value is 15.
- `xcex,ycex`: the font size of the x and y axis, respectively. The default values is 10.
- `lcex`: the font size of point labels in `dplot`
- `hjust, vjust`: the horizontal and vertical justification of point labels, respectively.
- `xlab, ylab`: the label of the x and y axis, respectively.
- `main`: the plot title

**Value**

An object created by `ggplot`.

**Author(s)**

Daryanaz Dargahi

**References**


**Examples**

```r
mat <- matrix(nrow = 5, ncol = 4, data = NA) rownames(mat) <- c("Ind1", "Ind2", "Ind3", "Ind4", "Group judgement") colnames(mat) <- c("Tumor_expression", "Normal_expression", "Frequency", "Epitopes") mat[1,] <- c(0.4915181, 0.3058879, 0.12487821, 0.07771583) mat[2,] <- c(0.3060687, 0.4949012, 0.12868606, 0.07034399) mat[3,] <- c(0.4627138, 0.3271881, 0.13574662, 0.07435149) mat[4,] <- c(0.6208484, 0.2414021, 0.07368481, 0.06406465) mat[5,] <- c(0.4697298, 0.3406738, 0.11600194, 0.07359445)
dplot(mat, xlab = "Coordinate 1", ylab = "Coordinate 2", main = "Distance plot")
```
epitope.PCM-data

A pairwise comparison matrix (PCM)

Description

epitope.PCM is a criteria with two subcriteria in the prioritization of a set of genes of interest. This file includes a PCM of the two subcriteria including number of epitopes and size of epitopes. The pairwise comparisons are performed according to the Saaty’s fundamental scale.

Author(s)

Daryanaz Dargahi

References


epitopeLength.PCM-data

A pairwise comparison matrix (PCM)

Description

EpitopeLength.PCM is a subcriteria (of the Epitope criterion) in the prioritization of a set of genes of interest. This file includes a PCM of the genes with respect to size (length) of epitopes according to the UniProt annotation (uniprot.org). The pairwise comparisons are performed according to the Saaty's fundamental scale.

Author(s)

Daryanaz Dargahi

References


epitopeNum.PCM-data

A pairwise comparison matrix (PCM)

Description

EpitopeNum.PCM is a subcriteria (of the Epitope criterion) in the prioritization of a set of genes of interest. This file includes a PCM of the genes with respect to the number of epitopes according to the UniProt annotation (uniprot.org). The pairwise comparisons are performed according to the Saaty’s fundamental scale.

Author(s)

Daryanaz Dargahi

References

Description
The rating categories and computed idealised priorities of alternatives (genes) with respect to their number of epitopes. This matrix is computed by the rating() function.

Author(s)
Daryanaz Dargahi

Description
The rating categories and computed idealised priorities of alternatives (genes) with respect to their epitope size. This matrix is computed by the rating() function.

Author(s)
Daryanaz Dargahi

Description
Freq.PCM is a criteria (with no subcriteria) in the prioritization of a set of genes of interest. This file includes a PCM of the genes with respect to their expression frequency in tumor tissue. The pairwise comparisons are performed according to the Saaty’s fundamental scale.

Author(s)
Daryanaz Dargahi

References
Description

The rating categories and computed idealised priorities of alternatives (genes) with respect to their expression frequency in tumor tissue. This matrix is computed by the rating() function.

Author(s)

Daryanaz Dargahi

describe:  
describe:  

Description

Aggregating individual judgments (pairwise comparison matrices - PCMs) into a group judgement or group priority.

Usage

gaggregate(srcfile, method = "geometric", simulation = 500)

Arguments

srcfile a matrix with one or two columns. Column one (required) includes the path (location) to each individual pairwise comparison matrix and column two (optional) includes the individual weights. The matrix rowname is individuals identifier.

method two methods are available for aggregation of individual opinions, (1) arithmetic, which compute the arithmetic mean of individual priorities, (2) geometric, which computes the geometric mean of individual PCMs. If individuals are assigned with a weight, the weighted arithmetic/geometric mean will be computed. The default method is 'geometric'.

simulation simulation size for computation of Satty’s inconsistency. The default value is 500.

Value

An S4 object including group PCM/prioritise;

If geometric mean is used, the returning object includes: aggregated group PCM (AII), group consistency ratio (GCR), individual consistency ratios (ICR), consensus index (CI), and priority matrix (IP).

If arithmetic mean is used, the returning object includes: aggregated group priority (AIP), individual consistency ratios (ICR), and priority matrix (IP).
Author(s)
Daryanaz Dargahi

References

Examples
mat <- matrix(nrow = 4, ncol = 1, data = NA)
mat[,1] <- c(system.file('extdata','ind1.tsv',package = 'Prize'),
            system.file('extdata','ind2.tsv',package = 'Prize'),
            system.file('extdata','ind3.tsv',package = 'Prize'),
            system.file('extdata','ind4.tsv',package = 'Prize'))
rownames(mat) <- c('ind1','ind2','ind3','ind4')
colnames(mat) <- c('individual_judgement')

# non-weighted aggregation
res <- gaggregate(srcfile = mat, method = 'geometric', simulation = 500)

# weighted aggregation
# Decision makers are assigned with a priority value based on their specialization and perspectives.
mat <- cbind(mat, c(0.35,0.25,0.15,0.25))
colnames(mat)[2] <- 'individual_weight'
res <- gaggregate(srcfile = mat, method = 'geometric', simulation = 500)

GCR (Group consistency ratio (GCR) slot)

Description
GCR (Group consistency ratio) is a slot of geoAggreg class. It consists of the consistency ratio of the aggregated group judgement.

Author(s)
Daryanaz Dargahi <daryanazdargahi@gmail.com>

Examples
mat <- matrix(nrow = 4, ncol = 1, data = NA)
mat[,1] <- c(system.file('extdata','ind1.tsv',package = 'Prize'),
            system.file('extdata','ind2.tsv',package = 'Prize'),
            system.file('extdata','ind3.tsv',package = 'Prize'),
            system.file('extdata','ind4.tsv',package = 'Prize'))
rownames(mat) <- c('ind1','ind2','ind3','ind4')
colnames(mat) <- c('individual_judgement')

# non-weighted aggregation
res <- gaggregate(srcfile = mat, method = 'geometric', simulation = 500)
GCR(res)
genes.list-data  

A pairwise comparison matrix (PCM)

Description

A matrix of genes to prioritize based on their tumor and normal expression, frequency of expression in tumor tissue, and number and size of epitopes.

Author(s)

Daryanaz Dargahi

geoAggreg-class  

Class geoAggreg

Description

An object that stores the aggregated group judgements as well as consistency ratio of the individuals and group judgements.

Objects from the Class

Objects can be created by calls of the form new("geoAggreg", ...).

Slots

AIJ: A matrix of aggregated group judgements (a pairwise comparison matrix).

GCR: The consistency ratio of the aggregated group judgement.

CI: A vector of the individuals consistency index.

ICR: A vector of individuals judgements consistency ratio.

IP: A matrix of individual and aggregated group AHP priorities.

Author(s)

Daryanaz Dargahi <daryanazdargahi@gmail.com>
ICR

*Individual consistency ratio (ICR) slot*

**Description**

Individual consistency ratio (ICR) is a slot of geoAggreg and ariAggreg classes. It consists of a vector of individuals' judgements consistency ratio.

**Author(s)**

Daryanaz Dargahi <daryanazdargahi@gmail.com>

**Examples**

```r
mat <- matrix(nrow = 4, ncol = 1, data = NA)
mat[,1] <- c(system.file('extdata', 'ind1.tsv', package = 'Prize'),
            system.file('extdata', 'ind2.tsv', package = 'Prize'),
            system.file('extdata', 'ind3.tsv', package = 'Prize'),
            system.file('extdata', 'ind4.tsv', package = 'Prize'))
rownames(mat) <- c('ind1', 'ind2', 'ind3', 'ind4')
colnames(mat) <- c('individual_judgement')

# Aggregation of individual judgements
res <- gaggregate(srcfile = mat, method = 'geometric', simulation = 500)
ICR(res)

# Aggregation of individual priorities
res <- gaggregate(srcfile = mat, method = 'arithmetic', simulation = 500)
ICR(res)
```

---

**ind1-data**

*An individual judgement matrix*

**Description**

A numeric square matrix generated based on Saaty’s fundamental scale. This matrix includes judgements of a decision maker.

**Author(s)**

Daryanaz Dargahi

**References**

An individual judgement matrix

Description

A numeric square matrix generated based on Saaty’s fundamental scale. This matrix includes judgements of a decision maker.

Author(s)

Daryanaz Dargahi

References

**Description**

IP (Individual priority) is a slot of geoAggreg and ariAggreg classes. It consists of a matrix of individual and aggregated group AHP priorities.

**Author(s)**

Daryanaz Dargahi <daryanazdargahi@gmail.com>

**Examples**

```r
mat <- matrix(nrow = 4, ncol = 1, data = NA)
mat[,1] <- c(system.file('extdata','ind1.tsv',package = 'Prize'),
           system.file('extdata','ind2.tsv',package = 'Prize'),
           system.file('extdata','ind3.tsv',package = 'Prize'),
           system.file('extdata','ind4.tsv',package = 'Prize'))
rownames(mat) <- c('ind1','ind2','ind3', 'ind4')
colnames(mat) <- c('individual_judgement')

# Aggregation of individual judgements
res <- gaggregate(srcfile = mat, method = 'geometric', simulation = 500)
IP(res)

# Aggregation of individual priorities
res <- gaggregate(srcfile = mat, method = 'arithmetic', simulation = 500)
IP(res)
```

---

**normal.PCM-data**

*A pairwise comparison matrix (PCM)*

**Description**

Normal.PCM is a criteria (with no subcriteria) in the prioritization of a set of genes of interest. This file includes a PCM of the genes with respect to their expression level in healthy (normal) tissues. The pairwise comparisons are performed according to the Saaty’s fundamental scale.

**Author(s)**

Daryanaz Dargahi

**References**

**Description**

The rating categories and computed idealised priorities of alternatives (genes) with respect to their expression in healthy (normal) tissues. This matrix is computed by the rating() function.

**Author(s)**

Daryanaz Dargahi

---

**Description**

A pairwise comparison matrix (PCM) of the categories defined for the number of epitopes subcriteria. The categories include: Single and Multiple. The pairwise comparisons are performed according to the Saaty’s fundamental scale.

**Author(s)**

Daryanaz Dargahi

**References**

pipeline

Description

A pipeline for prioritization estimation using analytic hierarchy process (AHP), which supports both relative and rating AHP models.

Usage

pipeline(srcfile, model, simulation = 500)

Arguments

srcfile
a character matrix, where the first column specifies the hierarchy order, the second column includes elements IDs, and the third column includes the path to the PCM/priority matrices (See the example below).

model
the AHP computation model. Choose from relative and rating models. If using the relative model pairwise comparison matrices must be provided for the evaluation of alternatives. However, if using the rating model, rating matrices must be provided for the evaluation of alternatives.

simulation
simulation size for computation of Saaty's inconsistency

Value

An S4 object including the ahp weight and consistency measures, and data structures to visualize with ahplot(), rainbowplot(), and wplot().

Author(s)

Daryanaz Dargahi

Examples

mat <- matrix(nrow = 7, ncol = 3, data = NA)
mat[,1] <- c('0', '1', '2', '3', '4', '4.1', '4.2')
mat[,2] <- c('Priority_of_DE_genes', 'Tumor_expression', 'Normal_expression',
'Frequency', 'Epitopes', 'Number_of_epitopes', 'Size_of_epitopes')
mat[,3] <- c(system.file('extdata', 'aggreg.judgement.tsv', package = 'Prize'),
  system.file('extdata', 'tumor.PCM.tsv', package = 'Prize'),
  system.file('extdata', 'normal.PCM.tsv', package = 'Prize'),
  system.file('extdata', 'freq.PCM.tsv', package = 'Prize'),
  system.file('extdata', 'epitope.PCM.tsv', package = 'Prize'),
  system.file('extdata', 'epitopeNum.PCM.tsv', package = 'Prize'),
  system.file('extdata', 'epitopeLength.PCM.tsv', package = 'Prize'))
result <- pipeline(mat, model = 'relative', simulation = 500)
pipelineObj-class  Class pipelineObj

Description
An object that stores the problem hierarchy as well as AHP priorities.

Objects from the Class
Objects can be created by calls of the form `new("pipelineObj", ...)`.

Slots
ahp_plot: A matrix of problem hierarchy.
weight_plot: A list of matrices representing AHP priorities at the criteria and subcriteria level.
rainbow_plot: A list of matrices representing final AHP ranking of alternatives at the criteria and subcriteria level.
ahp_weights: A list of matrices representing AHP priorities for all decision elements.
simulation: A numeric value of the simulation size.
saaty_inconsistency: A list of Saaty inconsistency ratios.

Author(s)
Daryanaz Dargahi <daryanazdargahi@gmail.com>

rainbowplot

Description
Plotting prioritized alternatives in a color-coded barplot, where a color is assigned to each criteria/subcriteria.

Usage
rainbowplot(srcfile, range = NULL, fontsize = 10, xcex = 4, ycex = 8, color = "rainbow", xlab = "Total priority score", ylab = "Alternative", digit = 3, dist = 0.02, main = NULL)

Arguments
srcfile a numeric matrix with alternatives on the rows and criteria/subcriteria on the columns. alternative’s AHP weights for each criteria, and the sum of each row on the last column (see example below).
range specifies which alternatives to plot. Either provide a range (e.g. 1:5) or a vector of numbers (e.g. c(2,5,12,20)). if range is NULL then all alternatives will be plotted. The default value is NULL.
rainbow_plot

The font size of the plot title, x and y axis labels, and legend. The default value is 10.

the font size of the labels on the bars. The default values is 4.

the font size of the y axis. The default values is 8.

color the color palette to fill bars. Either provide a vector of n colors, where n is the number of criteria/subcriteria, or choose from the following palettes 'rainbow, heat, terrain, topo, cm'. The default value is rainbow.

the label of the x and y axis, respectively.

the number of digits after decimal point to be shown on the bars. The default value is 3.

dist the distance between the bar and its label. The default value is 0.02.

Value

An object created by 'ggplot'.

Author(s)

Daryanaz Dargahi

Examples

mat <- matrix(c(0.007, 0.289, 0.033, 0.118, 0.447, 0.015, 0.155, 0.015, 0.088, 0.275, 0.048, 0.078, 0.007, 0.044, 0.177, 0.039, 0.042, 0.003, 0.017, 0.101), nrow = 4, ncol = 5, byrow = TRUE, dimnames = list(c('CA9', 'MUC16', 'CD70', 'MUC1'), c('Tumor_expression', 'Normal_expression', 'Style', 'Frequency', 'Epitopes')))
rainbowplot(mat, range = NULL, xlab = 'Total priority score', ylab = 'Alternative', dist = 0.04)

Description

rainbow_plot is a slot of pipelineObj class. It consists of a list of matrices representing final AHP ranking of alternatives at the criteria and subcriteria level.

Author(s)

Daryanaz Dargahi <daryanazdargahi@gmail.com>

Examples

mat <- matrix(nrow = 7, ncol = 3, data = NA)
mat[,1] <- c('0', '1', '2', '3', '4', '4.1', '4.2')
mat[,3] <- c(system.file('extdata', 'aggreg.judgement.tsv', package = 'Prize'), system.file('extdata', 'tumor.PCM.tsv', package = 'Prize'), system.file('extdata', 'normal.PCM.tsv', package = 'Prize'), system.file('extdata', 'freq.PCM.tsv', package = 'Prize'), system.file('extdata', 'epitope.PCM.tsv', package = 'Prize'), system.file('extdata', 'epitopeNum.PCM.tsv', package = 'Prize'), ...
```r
system.file('extdata', 'epitopeLength.PCM.tsv', package = 'Prize'))

result <- pipeline(mat, model = 'relative', simulation = 500)
rainbow_plot(result)
```

### Description

Estimates idealised priorities of alternatives (the rating AHP model).

### Usage

```r
rating(scale, alternative, NA_category = NULL, simulation = 500)
```

### Arguments

- **scale**: a pairwise comparison matrix (PCM) of rating categories.
- **alternative**: a N by 2 character matrix, where N is the number of alternatives. The matrix includes alternatives on column #1 and the rating category they belong to on column #2.
- **NA_category**: a character string or vector which specifies categories with the value of zero. Since zero is not achievable by PCM matrix.
- **simulation**: simulation size for computation of Saaty’s inconsistency

### Value

An S4 object including the raw and normalized ahp priorities, Satty’s inconsistency, and rating matrix.

### Author(s)

Daryanaz Dargahi

### References


### Examples

```r
mat <- matrix(nrow = 4, ncol = 4, data = NA)

# The category PCM matrix
rownames(mat) <- c('excellent', 'good', 'fair', 'poor')
colnames(mat) <- c('excellent', 'good', 'fair', 'poor')
mat[1,] <- c(1, 2, 4, 6)
mat[2,] <- c(NA, 1, 2, 4)
mat[3,] <- c(NA, NA, 1, 2)
```
mat[4,] <- c(NA,NA,NA,1)

# The alternative matrix
alt <- matrix(nrow = 5, ncol = 2, data = NA)
alt[,1] <- c("Andy", "Emily", "Nina", "Alex", "Jack")
alt[,2] <- c("good", "poor", "good", "fair", "excellent")

result <- rating(mat, alt, simulation = 500)

# Specifying a category with value of zero
alt <- rbind(alt, c('shannon', 'Not_available'))

result <- rating(mat, alt, NA_category = 'Not_available', simulation = 500)

---

**ratingObj-class**

**Class** ratingObj

---

**Description**

An object that stores the idealised priorities of alternatives (The rating AHP model).

**Objects from the Class**

Objects can be created by calls of the form `new("ratingObj", ...)`. 

**Slots**

weight: A matrix of rating categories and their AHP and idealised prioritise.
saaty_inconsistency: The consistency ratio of the categories pairwise comparison matrix.
RM: A matrix of alternatives with their scale category and idealised prioritise.

**Author(s)**

Daryanaz Dargahi <daryanazdargahi@gmail.com>

---

**RM**

**Rating matrix (RM) slot**

---

**Description**

RM (Rating matrix) is a slot of ratingObj class. It consists of a matrix of alternatives with their scale category and idealised prioritise.

**Author(s)**

Daryanaz Dargahi <daryanazdargahi@gmail.com>
Examples

```r
mat <- matrix(nrow = 4, ncol = 4, data = NA)
# Category PCM matrix
rownames(mat) <- c('excellent','good','fair','poor')
colnames(mat) <- c('excellent','good','fair','poor')
mat[1,] <- c(1,2,4,6)
mat[2,] <- c(NA,1,2,4)
mat[3,] <- c(NA,NA,1,2)
mat[4,] <- c(NA,NA,NA,1)

# Alternative matrix
alt <- matrix(nrow = 5, ncol = 2, data = NA)
alt[,1] <- c("Andy", "Emily", "Nina", "Alex", "Jack")
alt[,2] <- c("good", "poor", "good", "fair", "excellent")
result <- rating(mat, alt, simulation = 500)
RM(result)
```

`saty_inconsistency` Saaty inconsistency slot

Description

`saty_inconsistency` is a slot of ahpObj, pipelineObj, and ratingObj classes. It consists of Saaty’s consistency ratio of a pairwise comparison matrix.

Author(s)

Daryanaz Dargahi <daryanazdargahi@gmail.com>

Examples

```r
# ahp()
mat <- matrix(c(1,2,5, 1/2,1,'3', 1/5,1/3,1), nrow = 3, ncol = 3, byrow = TRUE)
res <- ahp(mat, simulation = 500)
saty_inconsistency(res)

# pipeline()
mat <- matrix(nrow = 7, ncol = 3, data = NA)
mat[,1] <- c(0, '1','2','3','4','4.1','4.2')
mat[,2] <- c('Prioritization_of_DE_genes','Tumor_expression','Normal_expression',
'Frequency', 'Epitopes', 'Number_of_epitopes', 'Size_of_epitopes')
mat[,3] <- c(system.file('extdata','aggreg.judgement.tsv',package = 'Prize'),
 system.file('extdata','tumor.PCM.tsv',package = 'Prize'),
 system.file('extdata','normal.PCM.tsv',package = 'Prize'),
 system.file('extdata','freq.PCM.tsv',package = 'Prize'),
 system.file('extdata','epitope.PCM.tsv',package = 'Prize'),
 system.file('extdata','epitopeNum.PCM.tsv',package = 'Prize'),
 system.file('extdata','epitopeLength.PCM.tsv',package = 'Prize'))
result <- pipeline(mat, model = 'relative', simulation = 500)
saty_inconsistency(result)
```
```r
# rating()
mat <- matrix(nrow = 4, ncol = 4, data = NA)
rownames(mat) <- c("excellent","good","fair","poor")
colnames(mat) <- c("excellent","good","fair","poor")
mat[1,] <- c(1,2,4,6)
mat[2,] <- c(NA,1,2,4)
mat[3,] <- c(NA,NA,1,2)
mat[4,] <- c(NA,NA,NA,1)
# Alternative matrix
alt <- matrix(nrow = 5, ncol = 2, data = NA)
alt[,1] <- c("Andy","Emily","Nina","Alex","Jack")
alt[,2] <- c("good","poor","good","fair","excellent")
result <- rating(mat, alt, simulation = 500)
saaty_inconsistency(result)
```

**simulation**

**Simulation slot**

**Description**

simulation is a slot of pipelineObj class. It consists of a numeric value of the simulation size (used in order to estimate Saaty’s consistency ratio).

**Author(s)**

Daryanaz Dargahi <daryanazdargahi@gmail.com>

**Examples**

```r
mat <- matrix(nrow = 7, ncol = 3, data = NA)
mat[,1] <- c("0","1","2","3","4","4.1","4.2")
mat[,2] <- c("Prioritization_of_DE_genes","Tumor_expression","Normal_expression",
            "Frequency","Epitopes","Number_of_epitopes","Size_of_epitopes")
mat[,3] <- c(system.file("extdata"),"aggreg.judgement.tsv",package = "Prize"),
            system.file("extdata"),"tumor.PCM.tsv",package = "Prize"),
            system.file("extdata"),"normal.PCM.tsv",package = "Prize"),
            system.file("extdata"),"freq.PCM.tsv",package = "Prize"),
            system.file("extdata"),"epitope.PCM.tsv",package = "Prize"),
            system.file("extdata"),"epitopeNum.PCM.tsv",package = "Prize"),
            system.file("extdata"),"epitopeLength.PCM.tsv",package = "Prize"))
result <- pipeline(mat, model = "relative", simulation = 500)
simulation(result)
```
**tumor.PCM-data**  
A pairwise comparison matrix (PCM)

**Description**

Tumor.PCM is a criteria (with no subcriteria) in the prioritization of a set of genes of interest. This file includes a PCM of the genes with respect to their expression level in tumor tissue. The pairwise comparisons are performed according to the Saaty’s fundamental scale.

**Author(s)**

Daryanaz Dargahi

**References**


---

**tumor_exp_rating-data**  
Rating categories and idealised priorities

**Description**

The rating categories and computed idealised priorities of alternatives (genes) with respect to their expression in tumor tissue. This matrix is computed by the rating() function.

**Author(s)**

Daryanaz Dargahi

---

**weight**  
Weight slot

**Description**

Weight is a slot of ahpObj and ratingObj classes. It consists of computed AHP weights from a pairwise comparison matrix.

**Author(s)**

Daryanaz Dargahi <daryanazdargahi@gmail.com>
Examples

# ahp()
mat <- matrix(c(1,2,5, 1/2,1,3, 1/5,1/3,1), nrow = 3, ncol = 3, byrow = TRUE)
res <- ahp(mat, simulation = 500)
weight(res)

# rating()
mat <- matrix(nrow = 4, ncol = 4, data = NA)
## Category PCM matrix
rownames(mat) <- c('excellent','good','fair','poor')
colnames(mat) <- c('excellent','good','fair','poor')
mat[1,] <- c(1,2,4,6)
mat[2,] <- c(NA,1,2,4)
mat[3,] <- c(NA,NA,1,2)
mat[4,] <- c(NA,NA,NA,1)
## Alternative matrix
alt <- matrix(nrow = 5, ncol = 2, data = NA)
alt[,1] <- c("Andy", "Emily", "Nina", "Alex", "Jack")
alt[,2] <- c("good", "poor", "good", "fair", "excellent")

result <- rating(mat, alt, simulation = 500)
weight(result)

weight_plot

Description

weight_plot is a slot of pipelineObj class. It consists of a list of matrices representing AHP priorities at the criteria and subcriteria level.

Author(s)

Daryanaz Dargahi <daryanazdargahi@gmail.com>

Examples

mat <- matrix(nrow = 7, ncol = 3, data = NA)
mat[,1] <- c('0', '1', '2', '3', '4', '4.1', '4.2')
mat[,2] <- c('Prioritization_of_DE_genes','Tumor_expression','Normal_expression',
'Frequency', 'Epitopes', 'Number_of_epitopes', 'Size_of_epitopes')
mat[,3] <- c(system.file('extdata','agreg.judgement.tsv',package = 'Prize'),
system.file('extdata','tumor.PCM.tsv',package = 'Prize'),
system.file('extdata','normal.PCM.tsv',package = 'Prize'),
system.file('extdata','freq.PCM.tsv',package = 'Prize'),
system.file('extdata','epitope.PCM.tsv',package = 'Prize'),
system.file('extdata','epitopeNum.PCM.tsv',package = 'Prize'),
system.file('extdata','epitopeLength.PCM.tsv',package = 'Prize'))
result <- pipeline(mat, model = 'relative', simulation = 500)
weight_plot(result)
wplot

Wplot

Description

Plotting the criteria/subcriteria ahp weights in a bar/pie plot.

Usage

wplot(srcfile, color = "rainbow", fontsize = 15, xcex = 10, ycex = 10,
      pcex = 5, digit = 2, xlab = NULL, ylab = NULL, type = "bar",
      main = NULL)

Arguments

srcfile a matrix, where the first column includes criteria/subcriteria ID and the second
         includes the ahp weights.

color the color palette to fill bars. Either provide a vector of n colors, where n is the
       number of criteria, or choose from the following palettes 'rainbow, heat, terrain,
       topo, cm'. The default value is rainbow.

fontsize the font size of the plot title, and x and y axis labels. The default value is 15.

xcex,ycex the font size of the x and y axis, respectively. The default values is 10.

cex the font size of the labels inside pie chart

digit the number of digits after decimal point to be shown on the x axis.

xlab,ylab the label of the x and y axis, respectively.

type wplot offers two plot types; bar and pie plots. Default value is bar.

main the plot title

Value

An object created by 'ggplot'.

Author(s)

Daryanaz Dargahi

Examples

mat <- matrix(nrow = 4, ncol = 2, data = NA)
mat[,1] <- c("Tumor_expression","Normal_expression","Frequency","Epitope")
mat[,2] <- c(0.470, 0.341, 0.116, 0.073)

wplot(mat, xlab = 'Weight', ylab = 'Criteria', type = 'bar')

wplot(mat, type = 'pie')
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