Package 'Clustering'

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Type Package

Title Techniques for Evaluating Clustering

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Author Luis Alfonso Perez Martos [aut, cre]

Maintainer Luis Alfonso Perez Martos <lapm0001@gmail.com>

Description
The design of this package allows us to run different clustering packages and compare the results between them, to determine which algorithm behaves best from the data provided.

URL https://github.com/laperez/clustering

Depends R (>= 3.5.0)

License GPL (>= 2)

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RoxygenNote 7.1.1

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Imports amap, apcluster, cluster, ClusterR, data.table, doParallel, dplyr, foreach, future, ggplot2, gmp, methods, pracma, pvclust, shiny, sqldf, stats, tools, utils, xtable, toOrdinal

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`appClustering` *Clustering GUI.*

Description

Method that allows us to execute the main algorithm in graphic interface mode instead of through the console.

Usage

```
appClustering()
```

Details

The operation of this method is to generate a graphical user. interface to be able to execute the clustering algorithm without knowing the parameters. Its operation is very simple, we can change the values and see the behavior quickly.

Value

GUI with the parameters of the algorithm and their representation in tables and graphs.

basketball *This data set contains a series of statistics (5 attributes) about 96 basketball players:*

Description

This data set contains a series of statistics about basketball players:

Usage

```
data(basketball)
```

Format

A data frame with 96 observations on 5 variables:

This data set contains a series of statistics about basketball players:

assists_per_minuteReal average number of assistances per minute

heightInteger height of the player

time_playedReal time played by the player

ageInteger number of years of the player

points_per_minuteReal average number of points per minute

Source

KEEL, <http://www.keel.es/>

best_ranked_external_metrics *Best rated external metrics.*

Description

Method in charge of searching for each algorithm those that have the best external classification.

Method that looks for those external attribute that are better classified, making use of the var column. In this way of discard attribute and only work with those that give the best response to the algorithm in question.

Usage

```
best_ranked_external_metrics(df)
```

Arguments

df	Matrix or data frame with the result of running the clustering algorithm.

Value

Returns a data.frame with the best classified external attribute.

Examples

```
result = clustering(
               df = cluster::agriculture,
               min = 4,
               max = 4,
               algorithm='gmm',
               metrics=c("Recall")
         )

best_ranked_external_metrics(df = result)
```

---

best_ranked_internal_metrics

Best rated internal metrics.

Description

Method in charge of searching for each algorithm those that have the best internal classification.

Method that looks for those internal attributes that are better classified, making use of the Var column. In this way we discard the attributes and only work with those that give the best response to the algorithm in question.

Usage

```
best_ranked_internal_metrics(df)
```

Arguments

df	Matrix or data frame with the result of running the clustering algorithm.

Value

Returns a data.frame with the best classified internal attributes.

Examples

```
result = clustering(
               df = cluster::agriculture,
               min = 4,
               max = 5,
               algorithm='gmm',
```

```
                metrics=c("Recall")
        )

best_ranked_internal_metrics(df = result)
```

`bolts` *Data from an experiment on the affects of machine adjustments on the time to count bolts.*

Description

A manufacturer of automotive accessories provides hardware, e.g. nuts, bolts, washers and screws, to fasten the accessory to the car or truck. Hardware is counted and packaged automatically. Specifically, bolts are dumped into a large metal dish. A plate that forms the bottom of the dish rotates counterclockwise. This rotation forces bolts to the outside of the dish and up along a narrow ledge. Due to the vibration of the dish caused by the spinning bottom plate, some bolts fall off the ledge and back into the dish. The ledge spirals up to a point where the bolts are allowed to drop into a pan on a conveyor belt. As a bolt drops, it passes by an electronic eye that counts it. When the electronic counter reaches the preset number of bolts, the rotation is stopped and the conveyor belt is moved forward

Usage

```
data(bolts)
```

Format

A data frame with 40 observations on 8 variables:

A manufacturer of automotive accessories provides hardware, e.g. nuts, bolts, washers and screws, to fasten the accessory to the car or truck. Hardware is counted and packaged automatically. Specifically, bolts are dumped into a large metal dish. A plate that forms the bottom of the dish rotates counterclockwise. This rotation forces bolts to the outside of the dish and up along a narrow ledge. Due to the vibration of the dish caused by the spinning bottom plate, some bolts fall off the ledge and back into the dish. The ledge spirals up to a point where the bolts are allowed to drop into a pan on a conveyor belt. As a bolt drops, it passes by an electronic eye that counts it. When the electronic counter reaches the preset number of bolts, the rotation is stopped and the conveyor belt is moved forward

RUNInteger is the order in which the data were collected

SPEED1Integer a speed setting that controls the speed of rotation of the plate at the bottom of the dish

TOTALInteger total number of bolts (TOTAL) to be counted

SPEED2Integer a second speed setting hat is used to change the speed of rotation (usually slowing it down) for the last few bolts

NUMBER2Integer the number of bolts to be counted at this second speed

SENSInteger the sensitivity of the electronic eye

TIMEReal The measured response is the time, in seconds

T20BOLTReal n order to put times on a equal footing the response to be analyzed is the time to count 20 bolts

Details

There are several adjustments on the machine that affect its operation. These include; a speed setting that controls the speed of rotation (SPEED1Integer) of the plate at the bottom of the dish, a total number of bolts (TOTAL) to be counted, a second speed setting (SPEED2Integer) that is used to change the speed of rotation (usually slowing it down) for the last few bolts, the number of bolts to be counted at this second speed (NUMBER2Integer), and the sensitivity of the electronic eye (SENSInteger). The sensitivity setting is to insure that the correct number of bolts are counted. Too few bolts packaged causes customer complaints. Too many bolts packaged increases costs. For each run conducted in this experiment the correct number of bolts was counted. From an engineering standpoint if the correct number of bolts is counted, the sensitivity should not affect the time to count bolts. The measured response is the time (TIMEReal), in seconds, it takes to count the desired number of bolts. In order to put times on a equal footing the response to be analyzed is the time to count 20 bolts (T20BOLTReal). Below are the data for 40 combinations of settings. RUNinteger is the order in which the data were collected.

Source

KEEL, <http://www.keel.es/>

`clustering` *Clustering algorithm.*

Description

Discovering the behavior of attributes in a set of clustering packages based on evaluation metrics.

Usage

```
clustering(
  path = NULL,
  df = NULL,
  packages = NULL,
  algorithm = NULL,
  min = 3,
  max = 4,
  metrics = NULL
)
```

Arguments

path	The path of file. NULL It is only allowed to use path or df but not both at the same time. Only files in .dat, .csv or arff format are allowed.
df	data matrix or data frame, or dissimilarity matrix. NULL If you want to use training and test basketball attributes.
packages	character vector with the packets running the algorithm. NULL The seven packages implemented are: cluster, ClusterR, amap, apcluster, pvclust. By default runs all packages.
algorithm	character vector with the algorithms implemented within the package. NULL The algorithms implemented are: hclust,apclusterK,agnes,clara,daisy, diana,fanny,mona,pam,gmm, kmeans_arma,kmeans_rcpp,mini_kmeans,pvclust.
min	An integer with the minimum number of clusters This data is necessary to indicate the minimum number of clusters when grouping the data. The default value is 3.
max	An integer with the maximum number of clusters. This data is necessary to indicate the maximum number of clusters when grouping the data. The default value is 4.
metrics	Character vector with the metrics implemented to evaluate the distribution of the data in clusters. NULL The night metrics implemented are: Entropy, Variation_information, Precision,Recall,F_measure,Fowlkes_mallows_index,Connectivity,Dunn and Silhouette.

Details

The operation of this algorithm is to evaluate how the attributes of a dataset or a set of datasets behave in different clustering algorithms. To do this, it is necessary to indicate the type of evaluation you want to make on the distribution of the data. To be able to execute the algorithm it is necessary to indicate the number of clusters.

min and max, the algorithms algorithm or packages.

packages that we want to cluster and the metrics metrics.

Value

A matrix with the result of running all the metrics of the algorithms contained in the packages indicated. We also obtain information with the types of metrics, algorithms and packages executed.

- result It is a list with the algorithms, metrics and variables defined in the execution of the algorithm.
- has_internal_metrics Boolean field to indicate if there are internal metrics such as: dunn, silhoutte and connectivity.
- has_external_metrics Boolean field to indicate if there are external metrics such as: precision, recall, f-measure, entropy, variation information and fowlkes-mallows.

- algorithms_execute Character vector with the algorithms executed. These algorithms have been mentioned in the definition of the parameters.
- measures_execute Character vector with the measures executed. These measures have been mentioned in the definition of the parameters.

Examples

```
clustering(
     df = cluster::agriculture,
     min = 3,
     max = 3,
     algorithm='clara',
     metrics=c('Precision')
)
```

`convert_toOrdinal` *Method to convert columns to ordinal.*

Description

Method to convert columns to ordinal.

Usage

```
convert_toOrdinal(df)
```

Arguments

`df`	data frame with the results.

Value

convert data frame to Ordinal.

`evaluate_best_validation_external_by_metrics` *Evaluates algorithms by measures of dissimilarity based on a metric.*

Description

Method that calculates which algorithm and which metric behaves best for the datasets provided.

Usage

```
evaluate_best_validation_external_by_metrics(df, metric)
```

Arguments

`df`	Data matrix or data frame with the result of running the clustering algorithm.
`metric`	String with the metric.

Details

Method groups the data by algorithm and distance measure, instead of obtaining the best attribute from the data set.

Value

A data.frame with the algorithms classified by measures of dissimilarity.

Examples

```
result = clustering(
               df = cluster::agriculture,
               min = 4,
               max = 5,
               algorithm='kmeans_rcpp',
               metrics=c("F_measure"))

evaluate_best_validation_external_by_metrics(result,'F_measure')
```

`evaluate_best_validation_internal_by_metrics` *Evaluates algorithms by measures of dissimilarity based on a metric.*

Description

Method that calculates which algorithm and which metric behaves best for the datasets provided.

Usage

```
evaluate_best_validation_internal_by_metrics(df, metric)
```

Arguments

`df`	Data matrix or data frame with the result of running the clustering algorithm.
`metric`	It's a string with the metric to evaluate.

Details

This method groups the data by algorithm and distance measure, instead of obtaining the best attribute from the data set.

Value

A data.frame with the algorithms classified by measures of dissimilarity.

Examples

```
result = clustering(
               df = cluster::agriculture,
               min = 4,
               max = 5,
               algorithm='gmm',
               metrics=c("Precision","Connectivity")
        )

evaluate_best_validation_internal_by_metrics(result,"Connectivity")
```

`evaluate_validation_external_by_metrics` *Evaluate external validations by algorithm.*

Description

Method that calculates which algorithm behaves best for the datasets provided.

Usage

```
evaluate_validation_external_by_metrics(df)
```

Arguments

`df`	data matrix or data frame with the result of running the clustering algorithm.

Details

It groups the results of the execution by algorithms.

Value

A data.frame with all the algorithms that obtain the best results regardless of the dissimilarity measure used.

Examples

```
result = clustering(
               df = cluster::agriculture,
               min = 4,
               max = 4,
               algorithm='kmeans_arma',
               metrics=c("Precision")
         )

evaluate_validation_external_by_metrics(result)
```

`evaluate_validation_internal_by_metrics` *Evaluate internal validations by algorithm.*

Description

Method that calculates which algorithm behaves best for the datasets provided.

Usage

```
evaluate_validation_internal_by_metrics(df)
```

Arguments

`df`	data matrix or data frame with the result of running the clustering algorithm.

Details

It groups the results of the execution by algorithms.

Value

A data.frame with all the algorithms that obtain the best results regardless of the dissimilarity measure used.

Examples

```
result = clustering(
               df = cluster::agriculture,
               min = 4,
               max = 5,
               algorithm='kmeans_rcpp',
               metrics=c("Recall","Silhouette")
         )

evaluate_validation_internal_by_metrics(result)

## Not run:
evaluate_validation_internal_by_metrics(result$result)

## End(Not run)
```

export_file_external *Export result of external metrics in latex.*

Description

Method that exports the results of external measurements in latex format to a file.

Usage

```
export_file_external(df, path = NULL)
```

Arguments

df	It's a dataframe that contains as a parameter a table in latex format with the results of the external validations.
path	It's a string with the path to a directory where a file is to be stored in latex format.

Details

When we work in latex format and we need to create a table to export the results, with this method we can export the results of the clustering algorithm to latex.

Value

A file in Latex format with the results of the external metrics.

Examples

```
result = clustering(
               df = cluster::agriculture,
               min = 4,
               max = 5,
               algorithm='gmm',
               metrics=c("Precision")
         )

export_file_external(result)
file.remove("external_data.tex")
```

`export_file_internal` *Export result of internal metrics in latex.*

Description

Method that exports the results of internal measurements in latex format to a file.

Usage

```
export_file_internal(df, path = NULL)
```

Arguments

`df`	It's a dataframe that contains as a parameter a table in latex format with the results of the internal validations.
`path`	It's a string with the path to a directory where a file is to be stored in latex format.

Details

When we work in latex format and we need to create a table to export the results, with this method we can export the results of the clustering algorithm to latex.

Value

A file in Latex format with the results of the internal metrics.

Examples

```
result = clustering(
               df = cluster::agriculture,
               min = 4,
               max = 5,
               algorithm='gmm',
               metrics=c("Recall","Dunn")
         )

export_file_internal(result)
file.remove("internal_data.tex")
```

plot_clustering *Graphic representation of the evaluation measures.*

Description

Graphical representation of the evaluation measures grouped by cluster.

Usage

```
plot_clustering(df, metric)
```

Arguments

df	data matrix or data frame with the result of running the clustering algorithm.
metric	it's a string with the name of the metric select to evaluate.

Details

In certain cases the review or filtering of the data is necessary to select the data, that is why thanks to the graphic representations this task is much easier. Therefore with this method we will be able to filter the data by metrics and see the data in a graphical way.

Value

Generate an image with the distribution of the clusters by metrics.

Examples

```
result = clustering(
               df = cluster::agriculture,
               min = 4,
               max = 5,
               algorithm='gmm',
               metrics=c("Precision")
         )

plot_clustering(result,c("Precision"))
```

`result_external_algorithm_by_metric` *External results by algorithm.*

Description

It is used for obtaining the results of an algorithm indicated as a parameter grouped by number of clusters.

Usage

```
result_external_algorithm_by_metric(df, metric)
```

Arguments

`df`	data matrix or data frame with the result of running the clustering algorithm.
`metric`	It's a string with the metric to evaluate.

Value

A data.frame with the results of the algorithm indicated as parameter.

Examples

```
result = clustering(
               df = cluster::agriculture,
               min = 4,
               max = 5,
               algorithm='gmm',
               metrics=c("Precision")
        )

result_external_algorithm_by_metric(result,'Precision')
```

`result_internal_algorithm_by_metric` *Internal results by algorithm*

Description

It is used for obtaining the results of an algorithm indicated as a parameter grouped by number of clusters.

Usage

```
result_internal_algorithm_by_metric(df, metric)
```

Arguments

df	data matrix or data frame with the result of running the clustering algorithm.
metric	It's a string with the metric we want to evaluate your results.

Value

A data.frame with the results of the algorithm indicated as parameter.

Examples

```
result = clustering(
               df = cluster::agriculture,
               min = 4,
               max = 5,
               algorithm='gmm',
               metrics=c("Recall","Silhouette")
        )

result_internal_algorithm_by_metric(result,'Silhouette')
```

---

sort.clustering *Returns the clustering result sorted by a set of metrics.*

Description

This function receives a clustering object and sorts the columns by parameter. By default it performs sorting by the algorithm field.

Usage

```
## S3 method for class 'clustering'
sort(x, decreasing = TRUE, ...)
```

Arguments

x	It's an clustering object.
decreasing	A logical indicating if the sort should be increasing or decreasing. By default, decreasing.
...	Additional parameters as "by", a String with the name of the evaluation measure to order by. Valid values are: Algorithm, Distance,Clusters, Data, Var, Time, Entropy, Variation_information,Precision, Recall, F_measure, Fowlkes_mallows_index, Connectivity, Dunn,Silhouette and TimeAtt.

Details

The additional argument in "..." is the 'by' argument, which is a array with the name of the evaluation measure to order by. Valid value are: `Algorithm`, `Distance`, `Clusters`, `Data`, `Var`, `Time`, `Entropy`,`Variation_information`, `Precision`, `Recall`, `F_measure`, `Fowlkes_mallows_index`,`Connectivity`, `Dunn`, `Silhouette`, `TimeAtt`.

Value

Another `clustering` object with the evaluation measures sorted

Examples

```
library(Clustering)

result <-
clustering(df = cluster::agriculture,min = 4, max = 4,algorithm='gmm',
metrics='Recall')

sort(result, FALSE, 'Recall')
```

---

stock *The data provided are daily stock prices from January 1988 through October 1991, for ten aerospace companies.*

Description

The data provided are daily stock prices from January 1988 through October 1991, for ten aerospace companies.

Usage

```
data(stock)
```

Format

A data frame with 950 observations on 10 variables:

The data provided are daily stock prices from January 1988 through October 1991, for ten aerospace companies.

Company1 company1 details

Company2 company2 details

Company3 company3 details

Company4 company4 details

Company5 company5 details

Company6 company6 details

Company7 company7 details

Company8 company8 details

Company9 company9 details

Company10 company10 details

Source

KEEL, <http://www.keel.es/>

`stulong` *The study was performed at the 2nd Department of Medicine, 1st Faculty of Medicine of Charles University and Charles University Hospital. The data were transferred to electronic form by the European Centre of Medical Informatics, Statisticsand Epidemiology of Charles University and Academy of Sciences.*

Description

The study was performed at the 2nd Department of Medicine, 1st Faculty of Medicine of Charles University and Charles University Hospital. The data were transferred to electronic form by the European Centre of Medical Informatics, Statisticsand Epidemiology of Charles University and Academy of Sciences.

Usage

```
data(stulong)
```

Format

A data frame with 1417 observations on 5 variables.

The study was performed at the 2nd Department of Medicine, 1st Faculty of Medicine of Charles University and Charles University Hospital. The data were transferred to electronic form by the European Centre of Medical Informatics, Statisticsand Epidemiology of Charles University and Academy of Sciences.

a1 Height

a2 Weight

a3 Blood pressure I systolic (mm Hg)

a4 Blood pressure I diastolic (mm Hg)

a5 ercentage Cholesterol in mg

Source

KEEL, <http://www.keel.es/>

transform_dataset *Method for filtering external columns of a dataset.*

Description

Method for filtering external columns of a dataset.

Usage

```
transform_dataset(df)
```

Arguments

df	Data frame with clustering results.

Value

Dafa frame filtered with the columns of the external measurements.

Exists internal measure

transform_dataset_internal *Method for filtering internal columns of a dataset.*

Description

Method for filtering internal columns of a dataset.

Usage

```
transform_dataset_internal(df)
```

Arguments

df	data frame with clustering results.

Value

dafa frame filtered with the columns of the internal measurements.

Exists internal measure

`weather` *One of the most known testing data sets in machine learning. This data sets describes several situations where the weather is suitable or not to play sports, depending on the current outlook, temperature, humidity and wind.*

Description

One of the most known testing data sets in machine learning. This data sets describes several situations where the weather is suitable or not to play sports, depending on the current outlook, temperature, humidity and wind.

Usage

```
data(weather)
```

Format

A data frame with 14 observations on 5 variables:

One of the most known testing data sets in machine learning. This data sets describes several situations where the weather is suitable or not to play sports, depending on the current outlook, temperature, humidity and wind.

Outlook sunny, overcast, rainy

Temperature hot, mild, cool

Humidity high, normal

Windy true, false

Play yes, no

Source

KEEL, <http://www.keel.es/>

`[.clustering` *Filter metrics in a* `clustering` *object returning a new* `clustering` *object.*

Description

Generates a new filtered `clustering` object.

Usage

```
## S3 method for class 'clustering'
clustering[condition = TRUE]
```

Arguments

clustering	The clustering object to filter.
condition	Expression to filter the clustering object.

Details

This function allows you to filter the data set for a given evaluation metric. The evaluation metrics available are: Algorithm, Distance, Clusters, Data, Var, Time, Entropy,Variation_information, Precision, Recall, F_measure, Fowlkes_mallows_index,Connectivity, Dunn, Silhouette and TimeAtt.

Value

A clustering object filtered from the input parameters.

Examples

```
library(Clustering)

result <- clustering(df = Clustering::basketball, algorithm = 'clara',
min=3, max=4, metrics = c('Precision','Recall'))

result[Precision > 0.14 & Recall > 0.11]
```

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