

WhiBoClustering

November 14, 2018

Type Package

Title White Box Clustering Algorithm Design

Version 0.1.2

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Description White Box Cluster Algorithm Design allows you to create Representative based cluster algorithm by using reusable components.

This way one can recreate already available cluster algorithms (i.e. K-Means, K-Means++, PAM) but also create new cluster algorithms not available in the literature or any other software.

For more information see papers <doi:10.1007/s10462-009-9133-6> and <doi:10.1016/j.datak.2012.03.005>.

License GPL-3

Depends graphics, stats, clusterCrit, cluster

Suggests methods, testthat

Encoding UTF-8

LazyData true

RoxygenNote 6.0.1

R topics documented:

plot.whibo_cluster	3
plot_pairs	4
predict.whibo_cluster	5
print.whibo_cluster	5
summary.whibo_cluster	6
wc_assignment	7
wc_assign_bhattacharyya_numerical	7
wc_assign_canberra	8
wc_assign_chebyshev	8
wc_assign_correlation	9
wc_assign_cosine	9
wc_assign_euclidean	10
wc_assign_fidelity_numerical	10
wc_assign_gower	11
wc_assign_hellinger_numerical	11

<code>wc_assign_inner_product</code>	12
<code>wc_assign_intersection</code>	13
<code>wc_assign_kulczynski</code>	13
<code>wc_assign_lorentzian</code>	14
<code>wc_assign_manhattan</code>	14
<code>wc_assign_sorensen</code>	15
<code>wc_assign_squared_euclidean</code>	15
<code>wc_assign_tanimoto</code>	16
<code>wc_assign_types</code>	16
<code>wc_assign_whittaker</code>	17
<code>wc_eval_ball_hall</code>	17
<code>wc_eval_banfeld_raftery</code>	18
<code>wc_eval_between_sum_of_squares</code>	18
<code>wc_eval_calinski_harabasz</code>	19
<code>wc_eval_c_index</code>	19
<code>wc_eval_davies_bouldin</code>	20
<code>wc_eval_det_ratio</code>	20
<code>wc_eval_dunn</code>	21
<code>wc_eval_gamma</code>	21
<code>wc_eval_g_plus</code>	22
<code>wc_eval_silhouette</code>	22
<code>wc_eval_total_sum_of_squares</code>	23
<code>wc_eval_within_sum_of_squares</code>	23
<code>wc_eval_xie_beni</code>	24
<code>wc_initialize</code>	24
<code>wc_init_agnes</code>	25
<code>wc_init_ccia</code>	25
<code>wc_init_diana</code>	26
<code>wc_init_forgy</code>	26
<code>wc_init_kkz</code>	27
<code>wc_init_kmeansplusplus</code>	27
<code>wc_init_pca</code>	28
<code>wc_init_quantile</code>	28
<code>wc_init_random</code>	29
<code>wc_init_types</code>	29
<code>wc_init_ward</code>	30
<code>wc_normalize</code>	30
<code>wc_norm_comprehensive</code>	31
<code>wc_norm_decimal_scaling</code>	31
<code>wc_norm_l1</code>	32
<code>wc_norm_l2</code>	32
<code>wc_norm_linf</code>	33
<code>wc_norm_log</code>	33
<code>wc_norm_max_min</code>	34
<code>wc_norm_mean</code>	34
<code>wc_norm_no</code>	35
<code>wc_norm_non_monotonic</code>	35
<code>wc_norm_sigmoid</code>	36
<code>wc_norm_softmax</code>	36
<code>wc_norm_types</code>	37
<code>wc_norm_z</code>	37
<code>wc_recalculate</code>	38

wc_recalculate_types	38
wc_recalc_geometric_mean	39
wc_recalc_harmonic_mean	39
wc_recalc_mean	40
wc_recalc_median	40
wc_recalc_midhinge	41
wc_recalc_midrange	41
wc_recalc_online_geometric_mean	42
wc_recalc_online_harmonic_mean	42
wc_recalc_online_mean	43
wc_recalc_online_median	43
wc_recalc_online_midhinge	44
wc_recalc_online_midrange	45
wc_recalc_online_quadratic_mean	45
wc_recalc_online_trimean	46
wc_recalc_online_trimmed_mean	47
wc_recalc_quadratic_mean	47
wc_recalc_trimean	48
wc_recalc_trimmed_mean	48
whibo_cluster-class	49
whibo_clustering	49

Index	51
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plot.whibo_cluster	<i>Plot WhiBo Cluster Representatives</i>
--------------------	---

Description

Plot WhiBo Cluster Representatives

Usage

```
## S3 method for class 'whibo_cluster'
plot(x, ...)
```

Arguments

x	WhiBo Cluster model.
...	None of those will be used.

Value

Line plot with Cluster representatives

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

Examples

```
data <- iris[, 1:4] #Numerical data only

model <- whibo_clustering(data = data, k = 3)
plot(model)
```

plot_pairs	<i>Plot WhiBo Cluster Representatives</i>
------------	---

Description

Plot WhiBo Cluster Representatives

Usage

```
plot_pairs(model, data)
```

Arguments

model	WhiBo Cluster model.
data	Data used for clustering (optional).

Value

Plotting pairs plot where Cluster representatives are presented with data (if provided).

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

Examples

```
data <- iris[, 1:4] #Numerical data only

model <- whibo_clustering(data = data, k = 3)
plot_pairs(model) #Plotting Cluster Representatives only

plot_pairs(model, data) #Plotting Cluster Representatives and Data
```

predict.whibo_cluster *Predict to which Cluster new data belongs*

Description

Predict to which Cluster new data belongs

Usage

```
## S3 method for class 'whibo_cluster'
predict(object, data, ...)
```

Arguments

object	WhiBo Cluster model.
data	Data for which Cluster should be obtained.
...	None of those will be used.

Value

Vector of assignments.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

Examples

```
data <- iris[1:100, 1:4] #Numerical data only and first 100 rows

model <- whibo_clustering(data = data, k = 3)
predict(object = model, data = iris[101:150, 1:4])
```

print.whibo_cluster *Show White-Box Cluster Algorithm model*

Description

Show White-Box Cluster Algorithm model

Usage

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

Arguments

x	WhiBo Cluster model.
...	None of those will be used.

Value

Summary text about Cluster model.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

See Also

summary.whibo_cluster

Examples

```
data <- iris[, 1:4] #Numerical data only

model <- whibo_clustering(data = data, k = 3)
print(model)
```

summary.whibo_cluster *Show White-Box Cluster Algorithm model*

Description

Show White-Box Cluster Algorithm model

Usage

```
## S3 method for class 'whibo_cluster'
summary(object, ...)
```

Arguments

object	WhiBo Cluster model.
...	None of those will be used.

Value

Summary text about Cluster model.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

See Also

print.whibo_cluster

Examples

```
data <- iris[, 1:4] #Numerical data only

model <- whibo_clustering(data = data, k = 3)
summary(model)
```

wc_assignment	<i>General Component for Assignment of data points to Cluster Representatives.</i>
---------------	--

Description

General Component for Assignment of data points to Cluster Representatives.

Usage

```
wc_assignment(data, centroids, assignment_type)
```

Arguments

data	A dataset for which data points needs to be assigned to Cluster Representatives.
centroids	Cluster representatives.
assignment_type	String which signal which assignment type to be used. Check <code>wc_assign_types</code> for possible values.

Value

A vector of assignments.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_assign_bhattacharyya_numerical	<i>Assign data points using Bhattacharyya distance.</i>
-----------------------------------	---

Description

Assign data points using Bhattacharyya distance.

Usage

```
wc_assign_bhattacharyya_numerical(data, centroids)
```

Arguments

data	A dataset for which data points needs to be assigned to Cluster Representatives.
centroids	Cluster representatives.

Value

A vector of assignments.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_assign_canberra	<i>Assign data points using Canberra distance.</i>
--------------------	--

Description

Assign data points using Canberra distance.

Usage

```
wc_assign_canberra(data, centroids)
```

Arguments

data	A dataset for which data points needs to be assigned to Cluster Representatives.
centroids	Cluster representatives.

Value

A vector of assignments.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_assign_chebyshev	<i>Assign data points using Chebyshev distance.</i>
---------------------	---

Description

Assign data points using Chebyshev distance.

Usage

```
wc_assign_chebyshev(data, centroids)
```


Arguments

data	A dataset for which data points needs to be assigned to Cluster Representatives.
centroids	Cluster representatives.

Value

A vector of assignments.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_assign_correlation *Assign data points using Correlation distance.*

Description

Assign data points using Correlation distance.

Usage

```
wc_assign_correlation(data, centroids)
```

Arguments

data	A dataset for which data points needs to be assigned to Cluster Representatives.
centroids	Cluster representatives.

Value

A vector of assignments.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_assign_cosine *Assign data points using Cosine distance.*

Description

Assign data points using Cosine distance.

Usage

```
wc_assign_cosine(data, centroids)
```

Arguments

data	A dataset for which data points needs to be assigned to Cluster Representatives.
centroids	Cluster representatives.

Value

A vector of assignments.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_assign_euclidean	<i>Assign data points using Euclidean distance.</i>
---------------------	---

Description

Assign data points using Euclidean distance.

Usage

```
wc_assign_euclidean(data, centroids)
```

Arguments

data	A dataset for which data points needs to be assigned to Cluster Representatives.
centroids	Cluster representatives.

Value

A vector of assignments.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_assign_fidelity_numerical	<i>Assign data points using Fidelity (numerical version) distance.</i>
------------------------------	--

Description

Assign data points using Fidelity (numerical version) distance.

Usage

```
wc_assign_fidelity_numerical(data, centroids)
```

Arguments

data A dataset for which data points needs to be assigned to Cluster Representatives.
centroids Cluster representatives.

Value

A vector of assignments.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_assign_gower	<i>Assign data points using Gower distance.</i>
-----------------	---

Description

Assign data points using Gower distance.

Usage

```
wc_assign_gower(data, centroids)
```

Arguments

data A dataset for which data points needs to be assigned to Cluster Representatives.
centroids Cluster representatives.

Value

A vector of assignments.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_assign_hellinger_numerical	<i>Assign data points using Hellinger (numerical version) distance.</i>
-------------------------------	---

Description

Assign data points using Hellinger (numerical version) distance.

Usage

```
wc_assign_hellinger_numerical(data, centroids)
```

Arguments

data	A dataset for which data points needs to be assigned to Cluster Representatives.
centroids	Cluster representatives.

Value

A vector of assignments.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_assign_inner_product

Assign data points using Inner product distance.

Description

Assign data points using Inner product distance.

Usage

```
wc_assign_inner_product(data, centroids)
```

Arguments

data	A dataset for which data points needs to be assigned to Cluster Representatives.
centroids	Cluster representatives.

Value

A vector of assignments.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

`wc_assign_intersection`*Assign data points using intersection distance.*

Description

Assign data points using intersection distance.

Usage

```
wc_assign_intersection(data, centroids)
```

Arguments

<code>data</code>	A dataset for which data points needs to be assigned to Cluster Representatives.
<code>centroids</code>	Cluster representatives.

Value

A vector of assignments.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

`wc_assign_kulczynski` *Assign data points using Kulczynski distance.*

Description

Assign data points using Kulczynski distance.

Usage

```
wc_assign_kulczynski(data, centroids)
```

Arguments

<code>data</code>	A dataset for which data points needs to be assigned to Cluster Representatives.
<code>centroids</code>	Cluster representatives.

Value

A vector of assignments.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_assign_lorentzian *Assign data points using Lorentzian distance.*

Description

Assign data points using Lorentzian distance.

Usage

```
wc_assign_lorentzian(data, centroids)
```

Arguments

data	A dataset for which data points needs to be assigned to Cluster Representatives.
centroids	Cluster representatives.

Value

A vector of assignments.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_assign_manhattan *Assign data points using Manhattan distance.*

Description

Assign data points using Manhattan distance.

Usage

```
wc_assign_manhattan(data, centroids)
```

Arguments

data	A dataset for which data points needs to be assigned to Cluster Representatives.
centroids	Cluster representatives.

Value

A vector of assignments.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_assign_sorensen	<i>Assign data points using Sorensen distance.</i>
--------------------	--

Description

Assign data points using Sorensen distance.

Usage

```
wc_assign_sorensen(data, centroids)
```

Arguments

data	A dataset for which data points needs to be assigned to Cluster Representatives.
centroids	Cluster representatives.

Value

A vector of assignments.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_assign_squared_euclidean	<i>Assign data points using squared Euclidean distance.</i>
-----------------------------	---

Description

Assign data points using squared Euclidean distance.

Usage

```
wc_assign_squared_euclidean(data, centroids)
```

Arguments

data	A dataset for which data points needs to be assigned to Cluster Representatives.
centroids	Cluster representatives.

Value

A vector of assignments.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_assign_tanimoto	<i>Assign data points using Tanimoto distance.</i>
--------------------	--

Description

Assign data points using Tanimoto distance.

Usage

```
wc_assign_tanimoto(data, centroids)
```

Arguments

data	A dataset for which data points needs to be assigned to Cluster Representatives.
centroids	Cluster representatives.

Value

A vector of assignments.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_assign_types	<i>Data frame for possible values of assignment types.</i>
-----------------	--

Description

Data frame for possible values of assignment types.

Usage

```
wc_assign_types
```

Format

An object of class `data.frame` with 18 rows and 2 columns.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_assign_whittaker	<i>Assign data points using Whittaker distance.</i>
---------------------	---

Description

Assign data points using Whittaker distance.

Usage

```
wc_assign_whittaker(data, centroids)
```

Arguments

data	A dataset for which data points needs to be assigned to Cluster Representatives.
centroids	Cluster representatives.

Value

A vector of assignments.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_eval_ball_hall	<i>Calculate Ball-Hall internal Cluster evaluation measure</i>
-------------------	--

Description

Calculate Ball-Hall internal Cluster evaluation measure

Usage

```
wc_eval_ball_hall(data, assignment)
```

Arguments

data	A dataset for which internal cluster quality should be calculated.
assignment	Vector of assignments.

Value

A value of internal cluster quality evaluation measure.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_eval_banfeld_raftery

Calculate Banfeld-Raftery internal Cluster evaluation measure

Description

Calculate Banfeld-Raftery internal Cluster evaluation measure

Usage

```
wc_eval_banfeld_raftery(data, assignment)
```

Arguments

data	A dataset for which internal cluster quality should be calculated.
assignment	Vector of assignments.

Value

A value of internal cluster quality evaluation measure.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_eval_between_sum_of_squares

Calculate between (Clusters) sum of squares

Description

Calculate between (Clusters) sum of squares

Usage

```
wc_eval_between_sum_of_squares(data, centroids, assignment)
```

Arguments

data	A dataset for which between sum of squared should be calculated.
centroids	A data frame of cluster representatives.
assignment	Vector of assignments.

Value

A vector of number which shows between (clusters) sum of squares.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

`wc_eval_calinski_harabasz`*Calculate Calinski-Harabasz internal Cluster evaluation measure*

Description

Calculate Calinski-Harabasz internal Cluster evaluation measure

Usage

```
wc_eval_calinski_harabasz(data, assignment)
```

Arguments

<code>data</code>	A dataset for which internal cluster quality should be calculated.
<code>assignment</code>	Vector of assignments.

Value

A value of internal cluster quality evaluation measure.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

`wc_eval_c_index`*Calculate C index internal Cluster evaluation measure*

Description

Calculate C index internal Cluster evaluation measure

Usage

```
wc_eval_c_index(data, assignment)
```

Arguments

<code>data</code>	A dataset for which internal cluster quality should be calculated.
<code>assignment</code>	Vector of assignments.

Value

A value of internal cluster quality evaluation measure.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

`wc_eval_davies_bouldin`*Calculate Davies-Bouldin internal Cluster evaluation measure*

Description

Calculate Davies-Bouldin internal Cluster evaluation measure

Usage

```
wc_eval_davies_bouldin(data, assignment)
```

Arguments

<code>data</code>	A dataset for which internal cluster quality should be calculated.
<code>assignment</code>	Vector of assignments.

Value

A value of internal cluster quality evaluation measure.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

`wc_eval_det_ratio`*Calculate Det ratio internal Cluster evaluation measure*

Description

Calculate Det ratio internal Cluster evaluation measure

Usage

```
wc_eval_det_ratio(data, assignment)
```

Arguments

<code>data</code>	A dataset for which internal cluster quality should be calculated.
<code>assignment</code>	Vector of assignments.

Value

A value of internal cluster quality evaluation measure.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

`wc_eval_dunn`*Calculate Dunn index internal Cluster evaluation measure*

Description

Calculate Dunn index internal Cluster evaluation measure

Usage

```
wc_eval_dunn(data, assignment)
```

Arguments

<code>data</code>	A dataset for which internal cluster quality should be calculated.
<code>assignment</code>	Vector of assignments.

Value

A value of internal cluster quality evaluation measure.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

`wc_eval_gamma`*Calculate Gamma index internal Cluster evaluation measure*

Description

Calculate Gamma index internal Cluster evaluation measure

Usage

```
wc_eval_gamma(data, assignment)
```

Arguments

<code>data</code>	A dataset for which internal cluster quality should be calculated.
<code>assignment</code>	Vector of assignments.

Value

A value of internal cluster quality evaluation measure.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_eval_g_plus	<i>Calculate G+ index internal Cluster evaluation measure</i>
----------------	---

Description

Calculate G+ index internal Cluster evaluation measure

Usage

```
wc_eval_g_plus(data, assignment)
```

Arguments

data	A dataset for which internal cluster quality should be calculated.
assignment	Vector of assignments.

Value

A value of internal cluster quality evaluation measure.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_eval_silhouette	<i>Calculate Silhouette score internal Cluster evaluation measure</i>
--------------------	---

Description

Calculate Silhouette score internal Cluster evaluation measure

Usage

```
wc_eval_silhouette(data, assignment)
```

Arguments

data	A dataset for which internal cluster quality should be calculated.
assignment	Vector of assignments.

Value

A value of internal cluster quality evaluation measure.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_eval_total_sum_of_squares
Calculate total sum of squares

Description

Calculate total sum of squares

Usage

```
wc_eval_total_sum_of_squares(data)
```

Arguments

data	A dataset for which total sum of squared should be calculated.
------	--

Value

A number which shows total sum of squares.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_eval_within_sum_of_squares
Calculate within (Cluster) sum of squares

Description

Calculate within (Cluster) sum of squares

Usage

```
wc_eval_within_sum_of_squares(data, centroids, assignment)
```

Arguments

data	A dataset for which within sum of squared should be calculated.
centroids	A data frame of cluster representatives.
assignment	Vector of assignments.

Value

A vector of number which shows within (cluster) sum of squares.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_eval_xie_beni	<i>Calculate Xie-Beni internal Cluster evaluation measure</i>
------------------	---

Description

Calculate Xie-Beni internal Cluster evaluation measure

Usage

```
wc_eval_xie_beni(data, assignment)
```

Arguments

data	A dataset for which internal cluster quality should be calculated.
assignment	Vector of assignments.

Value

A value of internal cluster quality evaluation measure.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_initialize	<i>General Component for Initialization of Cluster Representatives.</i>
---------------	---

Description

General Component for Initialization of Cluster Representatives.

Usage

```
wc_initialize(data, k = 3, initialization_type)
```

Arguments

data	A dataset for which Cluster Representatives needs to be initialized.
k	A number of Cluster Representatives.
initialization_type	String which signal which initialization type to be used. Check wc_init_types for possible values.

Value

As a result initial Cluster Representatives are obtained. Result is in for of data.frame or data.matrix.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_init_agnes	<i>AGNES Cluster Representatives initialization.</i>
---------------	--

Description

AGNES Cluster Representatives initialization.

Usage

```
wc_init_agnes(data, k)
```

Arguments

data	A dataset for which Cluster Representatives needs to be initialized.
k	A number of Cluster Representatives to be initialized.

Value

As a result initial Cluster Representatives are obtained. Result is in for of data.frame or data.matrix.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_init_ccia	<i>CCIA Cluster Representatives initialization.</i>
--------------	---

Description

CCIA Cluster Representatives initialization.

Usage

```
wc_init_ccia(data, k)
```

Arguments

data	A dataset for which Cluster Representatives needs to be initialized.
k	A number of Cluster Representatives to be initialized.

Value

As a result initial Cluster Representatives are obtained. Result is in for of data.frame or data.matrix.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_init_diana	<i>DIANA Cluster Representatives initialization.</i>
---------------	--

Description

DIANA Cluster Representatives initialization.

Usage

```
wc_init_diana(data, k)
```

Arguments

data	A dataset for which Cluster Representatives needs to be initialized.
k	A number of Cluster Representatives to be initialized.

Value

As a result initial Cluster Representatives are obtained. Result is in for of data.frame or data.matrix.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_init_forgy	<i>Forgy algorithm Cluster Representatives initialization.</i>
---------------	--

Description

Forgy algorithm Cluster Representatives initialization.

Usage

```
wc_init_forgy(data, k = 3)
```

Arguments

data	A dataset for which Cluster Representatives needs to be initialized.
k	A number of Cluster Representatives to be initialized.

Value

As a result initial Cluster Representatives are obtained. Result is in for of data.frame or data.matrix.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_init_kkz	<i>KKZ Cluster Representatives initialization.</i>
-------------	--

Description

KKZ Cluster Representatives initialization.

Usage

```
wc_init_kkz(data, k)
```

Arguments

data	A dataset for which Cluster Representatives needs to be initialized.
k	A number of Cluster Representatives to be initialized.

Value

As a result initial Cluster Representatives are obtained. Result is in for of data.frame or data.matrix.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_init_kmeansplusplus	<i>K-Means++ Cluster Representatives initialization.</i>
------------------------	--

Description

K-Means++ Cluster Representatives initialization.

Usage

```
wc_init_kmeansplusplus(data, k = 3)
```

Arguments

data	A dataset for which Cluster Representatives needs to be initialized.
k	A number of Cluster Representatives to be initialized.

Value

As a result initial Cluster Representatives are obtained. Result is in for of data.frame or data.matrix.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_init_pca	<i>PCA Cluster Representatives initialization.</i>
-------------	--

Description

PCA Cluster Representatives initialization.

Usage

```
wc_init_pca(data, k)
```

Arguments

data	A dataset for which Cluster Representatives needs to be initialized.
k	A number of Cluster Representatives to be initialized.

Value

As a result initial Cluster Representatives are obtained. Result is in for of data.frame or data.matrix.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_init_quantile	<i>Quantile Cluster Representatives initialization.</i>
------------------	---

Description

Quantile Cluster Representatives initialization.

Usage

```
wc_init_quantile(data, k)
```

Arguments

data	A dataset for which Cluster Representatives needs to be initialized.
k	A number of Cluster Representatives to be initialized.

Value

As a result initial Cluster Representatives are obtained. Result is in for of data.frame or data.matrix.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_init_random	<i>Random Cluster Representatives initialization.</i>
----------------	---

Description

Random Cluster Representatives initialization.

Usage

```
wc_init_random(data, k = 3)
```

Arguments

data	A dataset for which Cluster Representatives needs to be initialized.
k	A number of Cluster Representatives to be initialized.

Value

As a result initial Cluster Representatives are obtained. Result is in for of data.frame or data.matrix.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_init_types	<i>Data frame for possible values of initialization types.</i>
---------------	--

Description

Data frame for possible values of initialization types.

Usage

```
wc_init_types
```

Format

An object of class data.frame with 10 rows and 2 columns.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_init_ward	<i>Ward algorithm Cluster Representatives initialization.</i>
--------------	---

Description

Ward algorithm Cluster Representatives initialization.

Usage

```
wc_init_ward(data, k)
```

Arguments

data	A dataset for which Cluster Representatives needs to be initialized.
k	A number of Cluster Representatives to be initialized.

Value

As a result initial Cluster Representatives are obtained. Result is in for of data.frame or data.matrix.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_normalize	<i>General (Optional) Component for Normalization of data.</i>
--------------	--

Description

General (Optional) Component for Normalization of data.

Usage

```
wc_normalize(data, normalization_type)
```

Arguments

data	A dataset which needs to be normalized.
normalization_type	String which signal which normalization type to be used. Check wc_norm_types for possible values.

Value

As a result normalized data are obtained. Result is in for of data.frame or data.matrix.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_norm_comprehensive *Comprehensive normalization of data.*

Description

Comprehensive normalization of data.

Usage

```
wc_norm_comprehensive(data, model = NULL)
```

Arguments

data	A dataset which needs to be normalized.
model	Additional data needed for future data to be normalized using same normalization technique.

Value

As a result normalized data are obtained. Result is in for of data.frame or data.matrix.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_norm_decimal_scaling
Decimal scaling of data.

Description

Decimal scaling of data.

Usage

```
wc_norm_decimal_scaling(data, model = NULL)
```

Arguments

data	A dataset which needs to be normalized.
model	Additional data needed for future data to be normalized using same normalization technique.

Value

As a result normalized data are obtained. Result is in for of data.frame or data.matrix.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_norm_l1	<i>l₁ normalization of data.</i>
------------	---

Description

l_1 normalization of data.

Usage

```
wc_norm_l1(data, model = NULL)
```

Arguments

data	A dataset which needs to be normalized.
model	Additional data needed for future data to be normalized using same normalization technique.

Value

As a result normalized data are obtained. Result is in for of data.frame or data.matrix.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_norm_l2	<i>l₂ normalization of data.</i>
------------	---

Description

l_2 normalization of data.

Usage

```
wc_norm_l2(data, model = NULL)
```

Arguments

data	A dataset which needs to be normalized.
model	Additional data needed for future data to be normalized using same normalization technique.

Value

As a result normalized data are obtained. Result is in for of data.frame or data.matrix.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_norm_linf	l_∞ normalization of data.
--------------	-----------------------------------

Description

l_∞ normalization of data.

Usage

```
wc_norm_linf(data, model = NULL)
```

Arguments

data	A dataset which needs to be normalized.
model	Additional data needed for future data to be normalized using same normalization technique.

Value

As a result normalized data are obtained. Result is in for of data.frame or data.matrix.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_norm_log	Logarithmic normalization of data.
-------------	------------------------------------

Description

Logarithmic normalization of data.

Usage

```
wc_norm_log(data, model = NULL)
```

Arguments

data	A dataset which needs to be normalized.
model	Additional data needed for future data to be normalized using same normalization technique.

Value

As a result normalized data are obtained. Result is in for of data.frame or data.matrix.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_norm_max_min	<i>Max-Min normalization of data.</i>
-----------------	---------------------------------------

Description

Max-Min normalization of data.

Usage

```
wc_norm_max_min(data, model = NULL)
```

Arguments

data	A dataset which needs to be normalized.
model	Additional data needed for future data to be normalized using same normalization technique.

Value

As a result normalized data are obtained. Result is in for of data.frame or data.matrix.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_norm_mean	<i>Mean (Max-Min like) normalization of data.</i>
--------------	---

Description

Mean (Max-Min like) normalization of data.

Usage

```
wc_norm_mean(data, model = NULL)
```

Arguments

data	A dataset which needs to be normalized.
model	Additional data needed for future data to be normalized using same normalization technique.

Value

As a result normalized data are obtained. Result is in for of data.frame or data.matrix.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_norm_no	<i>Ignore normalization of data.</i>
------------	--------------------------------------

Description

Ignore normalization of data.

Usage

```
wc_norm_no(data, model = NULL)
```

Arguments

data	A dataset which needs to be normalized.
model	Additional data needed for future data to be normalized using same normalization technique.

Value

As a result normalized data are obtained. Result is in for of data.frame or data.matrix.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_norm_non_monotonic	<i>Non-monotonic normalization of data.</i>
-----------------------	---

Description

Non-monotonic normalization of data.

Usage

```
wc_norm_non_monotonic(data, model = NULL)
```

Arguments

data	A dataset which needs to be normalized.
model	Additional data needed for future data to be normalized using same normalization technique.

Value

As a result normalized data are obtained. Result is in for of data.frame or data.matrix.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_norm_sigmoid	<i>Sigmoid normalization of data.</i>
-----------------	---------------------------------------

Description

Sigmoid normalization of data.

Usage

```
wc_norm_sigmoid(data, model = NULL)
```

Arguments

data	A dataset which needs to be normalized.
model	Additional data needed for future data to be normalized using same normalization technique.

Value

As a result normalized data are obtained. Result is in for of data.frame or data.matrix.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_norm_softmax	<i>Softmax normalization of data.</i>
-----------------	---------------------------------------

Description

Softmax normalization of data.

Usage

```
wc_norm_softmax(data, model = NULL)
```

Arguments

data	A dataset which needs to be normalized.
model	Additional data needed for future data to be normalized using same normalization technique.

Value

As a result normalized data are obtained. Result is in for of data.frame or data.matrix.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_norm_types	<i>Data frame for possible values of normalization types.</i>
---------------	---

Description

Data frame for possible values of normalization types.

Usage

```
wc_norm_types
```

Format

An object of class data.frame with 13 rows and 2 columns.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_norm_z	<i>Z transformation of data.</i>
-----------	----------------------------------

Description

Z transformation of data.

Usage

```
wc_norm_z(data, model = NULL)
```

Arguments

data	A dataset which needs to be normalized.
model	Additional data needed for future data to be normalized using same normalization technique.

Value

As a result normalized data are obtained. Result is in form of data.frame or data.matrix.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_recalculate	<i>General Component for Cluster Representative update.</i>
----------------	---

Description

General Component for Cluster Representative update.

Usage

```
wc_recalculate(data, assignment, recalculate_type, assignment_type = NULL,
               old_centroids = NULL)
```

Arguments

data	A dataset for which Cluster Representatives needs to be updated.
assignment	Vector of Cluster assignments.
recalculate_type	String which signal which update type to be used. Check <code>wc_recalculate_types</code> for possible values.
assignment_type	Assignment type (Optional).
old_centroids	Old centroids (Optional).

Value

As a result new Cluster Representatives are obtained. Result is in for of `data.frame` or `data.matrix`.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_recalculate_types	<i>Data frame for possible values of recalculate types.</i>
----------------------	---

Description

Data frame for possible values of recalculate types.

Usage

```
wc_recalculate_types
```

Format

An object of class `data.frame` with 18 rows and 2 columns.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

`wc_recalc_geometric_mean`*Solution for Cluster Representative update which uses Geometric mean.*

Description

Solution for Cluster Representative update which uses Geometric mean.

Usage

```
wc_recalc_geometric_mean(data, assignment, old_centroids = NULL)
```

Arguments

<code>data</code>	A dataset for which Cluster Representatives needs to be updated.
<code>assignment</code>	Vector of Cluster assignments.
<code>old_centroids</code>	Old centroids.

Value

As a result new Cluster Representatives are obtained. Result is in for of data.frame or data.matrix.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

`wc_recalc_harmonic_mean`*Solution for Cluster Representative update which uses Harmonic mean.*

Description

Solution for Cluster Representative update which uses Harmonic mean.

Usage

```
wc_recalc_harmonic_mean(data, assignment, old_centroids = NULL)
```

Arguments

<code>data</code>	A dataset for which Cluster Representatives needs to be updated.
<code>assignment</code>	Vector of Cluster assignments.
<code>old_centroids</code>	Old centroids.

Value

As a result new Cluster Representatives are obtained. Result is in for of data.frame or data.matrix.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_recalc_mean

Solution for Cluster Representative update which uses Mean.

Description

Solution for Cluster Representative update which uses Mean.

Usage

```
wc_recalc_mean(data, assignment, old_centroids = NULL)
```

Arguments

data	A dataset for which Cluster Representatives needs to be updated.
assignment	Vector of Cluster assignments.
old_centroids	Old centroids.

Value

As a result new Cluster Representatives are obtained. Result is in for of data.frame or data.matrix.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_recalc_median

Solution for Cluster Representative update which uses Median.

Description

Solution for Cluster Representative update which uses Median.

Usage

```
wc_recalc_median(data, assignment, old_centroids = NULL)
```

Arguments

data	A dataset for which Cluster Representatives needs to be updated.
assignment	Vector of Cluster assignments.
old_centroids	Old centroids.

Value

As a result new Cluster Representatives are obtained. Result is in for of data.frame or data.matrix.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_recalc_midhinge	<i>Solution for Cluster Representative update which uses Midhinge.</i>
--------------------	--

Description

Solution for Cluster Representative update which uses Midhinge.

Usage

```
wc_recalc_midhinge(data, assignment, old_centroids = NULL)
```

Arguments

data	A dataset for which Cluster Representatives needs to be updated.
assignment	Vector of Cluster assignments.
old_centroids	Old centroids.

Value

As a result new Cluster Representatives are obtained. Result is in for of data.frame or data.matrix.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_recalc_midrange	<i>Solution for Cluster Representative update which uses Midrange.</i>
--------------------	--

Description

Solution for Cluster Representative update which uses Midrange.

Usage

```
wc_recalc_midrange(data, assignment, old_centroids = NULL)
```

Arguments

data	A dataset for which Cluster Representatives needs to be updated.
assignment	Vector of Cluster assignments.
old_centroids	Old centroids.

Value

As a result new Cluster Representatives are obtained. Result is in for of data.frame or data.matrix.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_recalc_online_geometric_mean

Solution for Cluster Representative update which uses Online Geometric mean.

Description

Solution for Cluster Representative update which uses Online Geometric mean.

Usage

```
wc_recalc_online_geometric_mean(data, assignment, assignment_type,
                                old_centroids = NULL)
```

Arguments

data	A dataset for which Cluster Representatives needs to be updated.
assignment	Vector of Cluster assignments.
assignment_type	Assignment type to be used.
old_centroids	Old centroids.

Value

As a result new Cluster Representatives are obtained. Result is in for of data.frame or data.matrix.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_recalc_online_harmonic_mean

Solution for Cluster Representative update which uses Online Harmonic mean.

Description

Solution for Cluster Representative update which uses Online Harmonic mean.

Usage

```
wc_recalc_online_harmonic_mean(data, assignment, assignment_type,
                                old_centroids = NULL)
```

Arguments

data	A dataset for which Cluster Representatives needs to be updated.
assignment	Vector of Cluster assignments.
assignment_type	Assignment type to be used.
old_centroids	Old centroids.

Value

As a result new Cluster Representatives are obtained. Result is in for of data.frame or data.matrix.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_recalc_online_mean *Solution for Cluster Representative update which uses Online mean.*

Description

Solution for Cluster Representative update which uses Online mean.

Usage

```
wc_recalc_online_mean(data, assignment, assignment_type, old_centroids = NULL)
```

Arguments

data	A dataset for which Cluster Representatives needs to be updated.
assignment	Vector of Cluster assignments.
assignment_type	Assignment type to be used.
old_centroids	Old centroids.

Value

As a result new Cluster Representatives are obtained. Result is in for of data.frame or data.matrix.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_recalc_online_median *Solution for Cluster Representative update which uses Online median.*

Description

Solution for Cluster Representative update which uses Online median.

Usage

```
wc_recalc_online_median(data, assignment, assignment_type,  
  old_centroids = NULL)
```

Arguments

data	A dataset for which Cluster Representatives needs to be updated.
assignment	Vector of Cluster assignments.
assignment_type	Assignment type to be used.
old_centroids	Old centroids.

Value

As a result new Cluster Representatives are obtained. Result is in for of data.frame or data.matrix.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_recalc_online_midhinge

Solution for Cluster Representative update which uses Online Midhinge.

Description

Solution for Cluster Representative update which uses Online Midhinge.

Usage

```
wc_recalc_online_midhinge(data, assignment, assignment_type,  
  old_centroids = NULL)
```

Arguments

data	A dataset for which Cluster Representatives needs to be updated.
assignment	Vector of Cluster assignments.
assignment_type	Assignment type to be used.
old_centroids	Old centroids.

Value

As a result new Cluster Representatives are obtained. Result is in for of data.frame or data.matrix.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_recalc_online_midrange

Solution for Cluster Representative update which uses Online Midrange.

Description

Solution for Cluster Representative update which uses Online Midrange.

Usage

```
wc_recalc_online_midrange(data, assignment, assignment_type,
                          old_centroids = NULL)
```

Arguments

data	A dataset for which Cluster Representatives needs to be updated.
assignment	Vector of Cluster assignments.
assignment_type	Assignment type to be used.
old_centroids	Old centroids.

Value

As a result new Cluster Representatives are obtained. Result is in for of data.frame or data.matrix.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_recalc_online_quadratic_mean

Solution for Cluster Representative update which uses Online Quadratic mean.

Description

Solution for Cluster Representative update which uses Online Quadratic mean.

Usage

```
wc_recalc_online_quadratic_mean(data, assignment, assignment_type,
                                old_centroids = NULL)
```

Arguments

data	A dataset for which Cluster Representatives needs to be updated.
assignment	Vector of Cluster assignments.
assignment_type	Assignment type to be used.
old_centroids	Old centroids.

Value

As a result new Cluster Representatives are obtained. Result is in for of data.frame or data.matrix.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_recalc_online_trimean

Solution for Cluster Representative update which uses Online Trimean.

Description

Solution for Cluster Representative update which uses Online Trimean.

Usage

```
wc_recalc_online_trimean(data, assignment, assignment_type,  
  old_centroids = NULL)
```

Arguments

data	A dataset for which Cluster Representatives needs to be updated.
assignment	Vector of Cluster assignments.
assignment_type	Assignment type to be used.
old_centroids	Old centroids.

Value

As a result new Cluster Representatives are obtained. Result is in for of data.frame or data.matrix.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_recalc_online_trimmed_mean

Solution for Cluster Representative update which uses Online Trimmed mean.

Description

Solution for Cluster Representative update which uses Online Trimmed mean.

Usage

```
wc_recalc_online_trimmed_mean(data, assignment, assignment_type,
                              old_centroids = NULL)
```

Arguments

data	A dataset for which Cluster Representatives needs to be updated.
assignment	Vector of Cluster assignments.
assignment_type	Assignment type to be used.
old_centroids	Old centroids.

Value

As a result new Cluster Representatives are obtained. Result is in for of data.frame or data.matrix.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_recalc_quadratic_mean

Solution for Cluster Representative update which uses Quadratic mean.

Description

Solution for Cluster Representative update which uses Quadratic mean.

Usage

```
wc_recalc_quadratic_mean(data, assignment, old_centroids = NULL)
```

Arguments

data	A dataset for which Cluster Representatives needs to be updated.
assignment	Vector of Cluster assignments.
old_centroids	Old centroids.

Value

As a result new Cluster Representatives are obtained. Result is in for of data.frame or data.matrix.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_recalc_trimean	<i>Solution for Cluster Representative update which uses Trimean.</i>
-------------------	---

Description

Solution for Cluster Representative update which uses Trimean.

Usage

```
wc_recalc_trimean(data, assignment, old_centroids = NULL)
```

Arguments

data	A dataset for which Cluster Representatives needs to be updated.
assignment	Vector of Cluster assignments.
old_centroids	Old centroids.

Value

As a result new Cluster Representatives are obtained. Result is in for of data.frame or data.matrix.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

wc_recalc_trimmed_mean	<i>Solution for Cluster Representative update which uses Trimmed mean.</i>
------------------------	--

Description

Solution for Cluster Representative update which uses Trimmed mean.

Usage

```
wc_recalc_trimmed_mean(data, assignment, old_centroids = NULL)
```

Arguments

data	A dataset for which Cluster Representatives needs to be updated.
assignment	Vector of Cluster assignments.
old_centroids	Old centroids.

Value

As a result new Cluster Representatives are obtained. Result is in for of data.frame or data.matrix.

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

whibo_cluster-class	<i>As S4 class to represent WhiBo Cluster model</i>
---------------------	---

Description

As S4 class to represent WhiBo Cluster model

Slots

whibo_cluster Whibo Clustering object - list of objects for White-Box Clustering

Author(s)

Sandro Radovanovic

whibo_clustering	<i>Find Cluster model using White-Box Cluster Algorithm Design.</i>
------------------	---

Description

Find Cluster model using White-Box Cluster Algorithm Design.

Usage

```
whibo_clustering(data, k = 3, normalization_type = "No",
  cluster_initialization_type = "Random", assignment_type = "Euclidean",
  recalculation_type = "Mean", max_iteration = 20, no_of_restarts = 1)
```

Arguments

data	Data on which clustering should be performed.
k	Number of Cluster Representatives.
normalization_type	Which normalization should be used (look at wc_norm_types for possible values). Default value is No.
cluster_initialization_type	Which initialization of Cluster Representatives should be used (look at wc_init_types for possible values). Default value is Random.
assignment_type	Which assignment function should be used (look at wc_assign_types for possible values). Default value is Euclidean.

recalculation_type

Which function for updating Cluster Representatives should be used (look at `wc_recalculate_types` for possible values). Default value is Mean.

max_iteration Number of iterations. Default value is 20.

no_of_restarts Number of restarts of whole clustering procedure. Default value is 1.

Value

Object of type `whibo_cluster` which include Cluster Representatives (centroids), number of elements per cluster (`elements_per_cluster`), assignments (`assignments`), measures of cluster quality (`within_sum_of_squares`, `between_ss_div_total_ss` and `internal_measures_of_quality`), cluster models per iterations (`model_history`), iterations (`iterations`) and parameters used (`params`)

Author(s)

Sandro Radovanovic <sandro.radovanovic@gmail.com>

See Also

`plot.whibo_cluster`, `predict.whibo_cluster`

Examples

```
data <- iris[, 1:4] #Take only numerical columns

#Perform k-means clustering
model <- whibo_clustering(data = data, k = 3)
model

#Perform some unorthodox clustering
model <- whibo_clustering(data = data, k = 3,
  normalization_type = 'Z', cluster_initialization_type = 'Ward',
  assignment_type = 'Correlation', recalculation_type = 'Trimean')
```

Index

*Topic **datasets**

- [wc_assign_types, 16](#)
 - [wc_init_types, 29](#)
 - [wc_norm_types, 37](#)
 - [wc_recalculate_types, 38](#)
- [plot.whibo_cluster, 3](#)
- [plot_pairs, 4](#)
- [predict.whibo_cluster, 5](#)
- [print.whibo_cluster, 5](#)
- [summary.whibo_cluster, 6](#)
- [wc_assign_bhattacharyya_numerical, 7](#)
- [wc_assign_canberra, 8](#)
- [wc_assign_chebyshev, 8](#)
- [wc_assign_correlation, 9](#)
- [wc_assign_cosine, 9](#)
- [wc_assign_euclidean, 10](#)
- [wc_assign_fidelity_numerical, 10](#)
- [wc_assign_gower, 11](#)
- [wc_assign_hellinger_numerical, 11](#)
- [wc_assign_inner_product, 12](#)
- [wc_assign_intersection, 13](#)
- [wc_assign_kulczynski, 13](#)
- [wc_assign_lorentzian, 14](#)
- [wc_assign_manhattan, 14](#)
- [wc_assign_sorensen, 15](#)
- [wc_assign_squared_euclidean, 15](#)
- [wc_assign_tanimoto, 16](#)
- [wc_assign_types, 16](#)
- [wc_assign_whittaker, 17](#)
- [wc_assignment, 7](#)
- [wc_eval_ball_hall, 17](#)
- [wc_eval_banfeld_raftery, 18](#)
- [wc_eval_between_sum_of_squares, 18](#)
- [wc_eval_c_index, 19](#)
- [wc_eval_calinski_harabasz, 19](#)
- [wc_eval_davies_bouldin, 20](#)
- [wc_eval_det_ratio, 20](#)
- [wc_eval_dunn, 21](#)
- [wc_eval_g_plus, 22](#)
- [wc_eval_gamma, 21](#)
- [wc_eval_silhouette, 22](#)
- [wc_eval_total_sum_of_squares, 23](#)
- [wc_eval_within_sum_of_squares, 23](#)
- [wc_eval_xie_beni, 24](#)
- [wc_init_agnes, 25](#)
- [wc_init_ccia, 25](#)
- [wc_init_diana, 26](#)
- [wc_init_forgy, 26](#)
- [wc_init_kkz, 27](#)
- [wc_init_kmeansplusplus, 27](#)
- [wc_init_pca, 28](#)
- [wc_init_quantile, 28](#)
- [wc_init_random, 29](#)
- [wc_init_types, 29](#)
- [wc_init_ward, 30](#)
- [wc_initialize, 24](#)
- [wc_norm_comprehensive, 31](#)
- [wc_norm_decimal_scaling, 31](#)
- [wc_norm_l1, 32](#)
- [wc_norm_l2, 32](#)
- [wc_norm_linf, 33](#)
- [wc_norm_log, 33](#)
- [wc_norm_max_min, 34](#)
- [wc_norm_mean, 34](#)
- [wc_norm_no, 35](#)
- [wc_norm_non_monotonic, 35](#)
- [wc_norm_sigmoid, 36](#)
- [wc_norm_softmax, 36](#)
- [wc_norm_types, 37](#)
- [wc_norm_z, 37](#)
- [wc_normalize, 30](#)
- [wc_recalc_geometric_mean, 39](#)
- [wc_recalc_harmonic_mean, 39](#)
- [wc_recalc_mean, 40](#)
- [wc_recalc_median, 40](#)
- [wc_recalc_midhinge, 41](#)
- [wc_recalc_midrange, 41](#)
- [wc_recalc_online_geometric_mean, 42](#)
- [wc_recalc_online_harmonic_mean, 42](#)
- [wc_recalc_online_mean, 43](#)
- [wc_recalc_online_median, 43](#)
- [wc_recalc_online_midhinge, 44](#)
- [wc_recalc_online_midrange, 45](#)
- [wc_recalc_online_quadratic_mean, 45](#)

`wc_recalc_online_trimean`, [46](#)
`wc_recalc_online_trimmed_mean`, [47](#)
`wc_recalc_quadratic_mean`, [47](#)
`wc_recalc_trimean`, [48](#)
`wc_recalc_trimmed_mean`, [48](#)
`wc_recalculate`, [38](#)
`wc_recalculate_types`, [38](#)
`whibo_cluster-class`, [49](#)
`whibo_clustering`, [49](#)