

Aglomer.NET

A hierarchical agglomerative clustering (HAC) library written in C#

Agglomer.NET is a .NET open-source library written entirely in C# that implements *hierarchical clustering* (HC) algorithms. A *cluster* refers to a *set of instances* or data-points. HC can either be *agglomerative* (bottom-up approach) or *divisive* (top-down approach). The distance between each instance is calculated using some *dissimilarity function*. The distance between clusters is calculated using some *linkage criterion*. Each step of HC produces a new *cluster-set*, *i.e.*, a *set of clusters*, from the cluster-set of the previous step.

Agglomerative HC starts with a cluster-set in which each instance belongs to its own cluster. At each step, it merges the two closest clusters, until all clusters have been merged into a single cluster containing all instances, *i.e.*, it ends with a cluster-set containing a single cluster with all instances. *Divisive HC* works in reverse — it starts by having a cluster-set with one cluster containing all instances. At each step, it splits clusters recursively, using some *splitting method*, until reaching one cluster-set containing only singletons, *i.e.*, where each instance is placed in its own cluster.

The *clustering result* is a list containing the cluster-set and the corresponding dissimilarity / distance at which it was created at each step of the algorithm. The result is organized in a hierarchical form, *i.e.*, where each cluster references either the *two parents* that were merged for its creation (in the agglomerative approach), or the *two children* resulting from splitting the cluster (in the divisive approach). Due to their hierarchical nature, clustering results can be visualized via a [dendrogram](#).

Currently, Agglomer.NET implements *program AGNES* (AGglomerative NESTing) of [Kaufman & Rousseeuw, 1990], *i.e.*, the bottom-up approach, the It supports different linkage criteria and also provides several metrics to perform internal and external evaluation of clustering results. The results of clustering can be exported to a Json file to be visualized as a dendrogram in *DendrogramViewer*, an interactive web-application using D3.js.

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About

Aglomera.NET is open-source under the [MIT license](#) and is free for commercial use.

- Source repository: <https://github.com/pedrodb/Aglomera>
- Issue tracker: <https://github.com/pedrodb/Aglomera/issues>

Supported platforms:

- All runtimes supporting *.NET Standard 1.3+* (*.NET Core 1.0+*, *.NET Framework 4.6+*) on Windows, Linux and Mac

API Documentation

- [HTML](#)
- [Windows Help file \(CHM\)](#)
- [PDF document](#)

Packages and Dependencies

The following packages with the corresponding dependencies are provided:

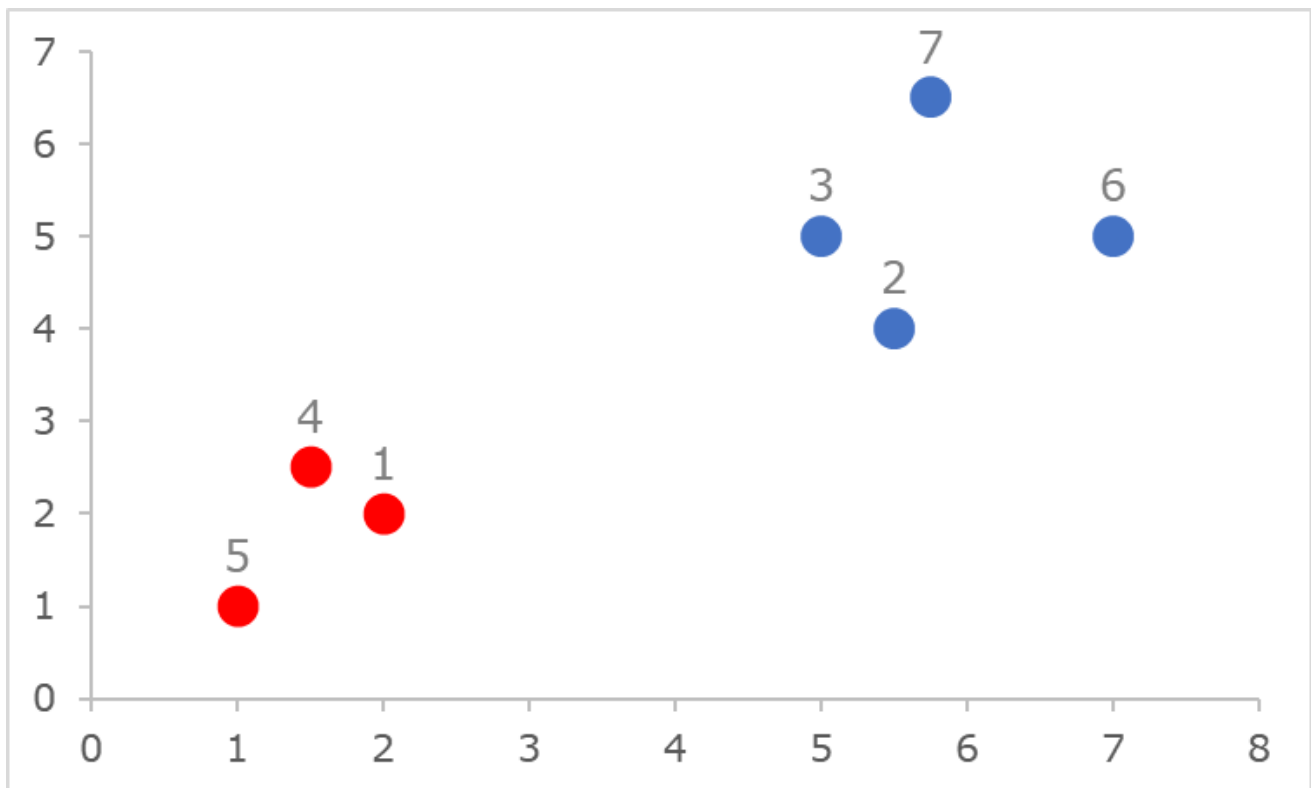
- **Aglomera**: core package, including clustering algorithm, linkage criteria and evaluation metrics.
- **Aglomera.D3**: package to export clustering results to Json files to be visualized with D3.js.
 - [Json.NET](#) v11.0.2

Installation

You can `git clone` the Aglomera.NET [source code](#) and use an IDE like VisualStudio to build the corresponding binaries.

Getting started

Consider the following *data-set* example taken from [Kaufman & Rousseeuw, 1990]:



where colors indicate the "real" instance class, *i.e.*, either 'A=red' or 'B=blue'.

Start by defining a *data-point* class, for example one to represent points in a 2D Euclidean space, such as:

```
class DataPoint : IComparable<DataPoint>
{
    public DataPoint(string id, double x, double y) { ... }
    public int CompareTo(DataPoint other) { ... }
    ...
}
```

and then define a *dissimilarity metric* for this type:

```
class DissimilarityMetric : IDissimilarityMetric<DataPoint>
{
    public double Calculate(DataPoint instance1, DataPoint instance2) { ... }
}
```

We can then define the *data-set* by using:

```
var dataPoints = new HashSet<DataPoint>(
    new[]
    {
        new DataPoint("1", 2.00, 2.00),
        new DataPoint("2", 5.50, 4.00),
        new DataPoint("3", 5.00, 5.00),
        new DataPoint("4", 1.50, 2.50),
        new DataPoint("5", 1.00, 1.00),
        new DataPoint("6", 7.00, 5.00),
        new DataPoint("7", 5.75, 6.50)
    });
```

We now select a *linkage criterion* and create the *clustering algorithm*:

```
var metric = new DissimilarityMetric();
var linkage = new AverageLinkage<DataPoint>(metric);
var algorithm = new AgglomerativeClusteringAlgorithm<DataPoint>(linkage);
```

The *clustering result* is then obtained by simply executing:

```
var clusteringResult = algorithm.GetClustering(dataPoints);
```

Enumerating the result (a `ClusteringResult<DataPoint>` object) yields the following:

```
[0] {0.000  {(1), (2), (3), (4), (5), (6), (7)}}
[1] {0.707  {(2), (3), (5), (6), (7), (1;4)}}
[2] {1.118  {(5), (6), (7), (1;4), (2;3)}}
[3] {1.498  {(6), (7), (2;3), (1;4;5)}}
[4] {1.901  {(7), (1;4;5), (2;3;6)}}
[5] {2.047  {(1;4;5), (2;3;6;7)}}
[6] {5.496  {(1;4;5;2;3;6;7)}}
```

from which we can select the appropriate data-set, *e.g.*, according to the number of clusters, the distance, external criteria, etc.

Features

- Supports the following **linkage criteria**, used to consider the dissimilarity between clusters:
 - *Complete* (farthest neighbor), *average* (UPGMA), *centroid*, *minimum energy*, *single* (nearest neighbor), *Ward's minimum variance* method.
- Provides the following **external clustering evaluation criteria**, used to evaluate the quality of a given cluster-set when each data-point has associated a certain label / class:
 - *Purity*, *normalized mutual information*, *accuracy*, *precision*, *recall*, *F-measure*.
 - To externally-evaluate the clustering result, start by indicating the *class* of each data-point, *e.g.*, a `char`, and an evaluation criterion:

```
var pointClasses = new Dictionary<DataPoint, char>{...};
var criterion = new NormalizedMutualInformation<DataPoint, char>();
```

The evaluation score of the 5th cluster-set is given by executing:

```
var score = criterion.Evaluate(clusteringResult[5], pointClasses);
```

- Provides the following **internal clustering evaluation criteria**, used to select the optimal number of clusters when *no ground truth is available*:
 - *Silhouette coefficient, Dunn index, Davies-Bouldin index, Calinski-Harabasz index, Modified Gamma statistic, Xie-Beni index, within-between ratio, I-index, Xu index, RMSSD, R-squared.*
 - To internally-evaluate the clustering result, we simply choose an evaluation criterion and calculate the score:

```
var criterion = new SilhouetteCoefficient<DataPoint>(metric);
var score = criterion.Evaluate(clusteringResult[5]);
```

- **CSV export**

- To export the result of clustering to a comma-separated values (CSV) file, we simply do:

```
clusteringResult.SaveToCsv(FILE_PATH);
```

which would produce a CSV file with the contents of each cluster in the cluster-set of each step of the algorithm, one instance per line.

- **D3.js export**

- Export the *result of clustering* to a Json file that contains the hierarchical structure of the clustering procedure that can be loaded into *DendrogramViewer* to produce a *dendrogram*, e.g.:

```
using Agglomera.D3;
...
clusteringResult.SaveD3DendrogramFile(fullPath, formatting: Formatting.Indented);
```

would produce Json text like the following:

```
{
  "n": "(1;4;5;2;3;6;7)", "d": 5.5,
  "c": [
    { "n": "(2;3;6;7)", "d": 2.05,
      "c": [
        {
          "n": "(2;3;6)", "d": 1.9,
          "c": [
            {
              "n": "(2;3)", "d": 1.12,
```

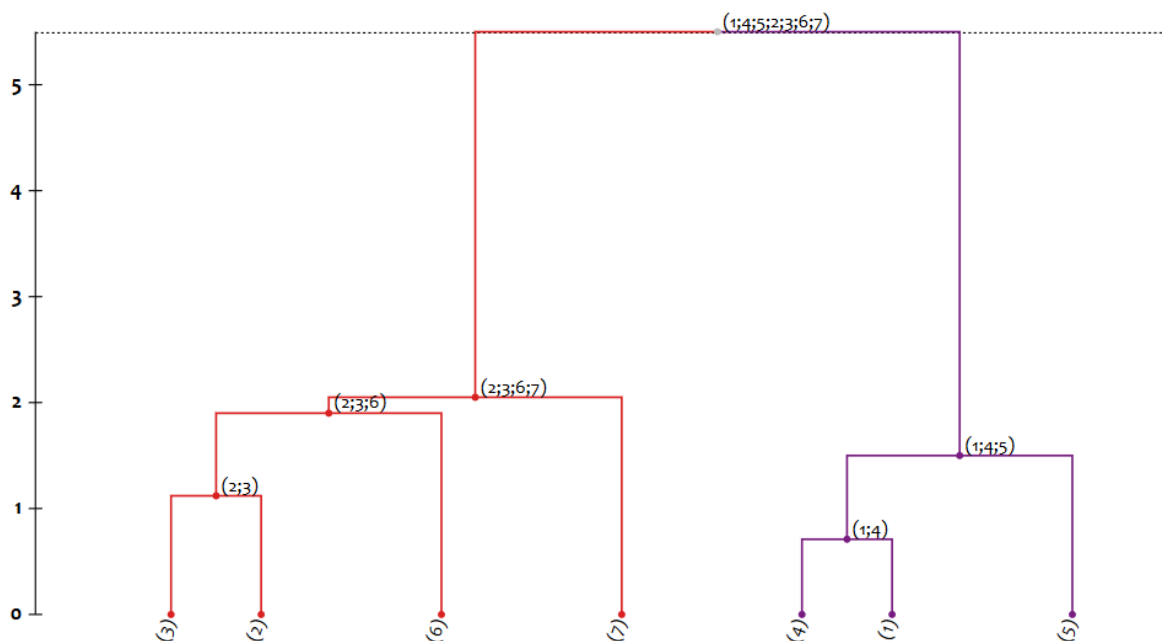
```

    "c": [
      { "n": "(3)", "d": 0.0, "c": [] },
      { "n": "(2)", "d": 0.0, "c": [] } ] },
    { "n": "(6)", "d": 0.0, "c": [] } ] },
    { "n": "(7)", "d": 0.0, "c": [] } ]
  },
  { "n": "(1;4;5)", "d": 1.5,
    "c": [
      { "n": "(1;4)", "d": 0.71,
        "c": [
          { "n": "(4)", "d": 0.0, "c": [] },
          { "n": "(1)", "d": 0.0, "c": [] } ] },
      { "n": "(5)", "d": 0.0, "c": [] } ]
    } ]
}

```

where **n** holds the name or id of the cluster, **d** is the dissimilarity / distance at which it was found and created, and **c** contains the list containing the pair of parents or children of the cluster.

- When loaded in *DendrogramViewer*, this would produce the following dendrogram:



Examples

Example code can be found in the [src/Examples](#) folder in the [repository](#). Several open-source data-sets adapted to work with the example applications can be found in [src/Examples/datasets](#).

- NumericClustering:** a simple example of using agglomerative HC to cluster a data-set loaded from an external CSV file. Several linkage criteria are used and clustering results are saved to CSV and D3 Json files.
- InternalClusteringEvaluation:** shows how to perform evaluation of clustering results using internal criteria. A data-set is loaded from an external CSV file and clustered using agglomerative HC. For each

internal criterion, the optimal cluster-set in the clustering result is selected by maximizing the score.

- **ExternalClusteringEvaluation:** shows how to perform evaluation of clustering results using external criteria. A labeled data-set is loaded from an external CSV file and clustered using agglomerative HC. The class of each instance is given by the first character of its id. The score of several external criteria for each cluster-set in the clustering result is then printed to the Console.

See Also

References








1. Kaufman, L., & Rousseeuw, P. J. (1990). [*Finding groups in data: an introduction to cluster analysis*](#). John Wiley & Sons.
2. Szekely, G. J., & Rizzo, M. L. (2005). [Hierarchical clustering via joint between-within distances: Extending Ward's minimum variance method](#). *Journal of classification*, 22(2), 151-183.
3. Rousseeuw, P. J. (1987). [Silhouettes: a graphical aid to the interpretation and validation of cluster analysis](#). *Journal of computational and applied mathematics*, 20, 53-65.
4. Dunn, J. C. (1973). [A fuzzy relative of the ISODATA process and its use in detecting compact well-separated clusters](#). *Journal of Cybernetics*, 3(3), 32-57.
5. Davies, D. L., & Bouldin, D. W. (1979). [A cluster separation measure](#). *IEEE transactions on pattern analysis and machine intelligence*, (2), 224-227.
6. Caliński, T., & Harabasz, J. (1974). [A dendrite method for cluster analysis](#). *Communications in Statistics-theory and Methods*, 3(1), 1-27.
7. Hubert, L., & Arabie, P. (1985). [Comparing partitions](#). *Journal of classification*, 2(1), 193-218.
8. Zhao, H., Liang, J., & Hu, H. (2006). [Clustering Validity Based on the Improved Hubert\Gamma Statistic and the Separation of Clusters](#). In *First International Conference on Innovative Computing, Information and Control, 2006. ICICIC'06*. (Vol. 2, pp. 539-543). IEEE.
9. Xie, X. L., & Beni, G. (1991). [A validity measure for fuzzy clustering](#). *IEEE Transactions on pattern analysis and machine intelligence*, 13(8), 841-847.
10. Zhao, Q., Xu, M., & Fränti, P. (2009). [Sum-of-squares based cluster validity index and significance analysis](#). In *International Conference on Adaptive and Natural Computing Algorithms* (pp. 313-322). Springer, Berlin, Heidelberg.
11. Maulik, U., & Bandyopadhyay, S. (2002). [Performance evaluation of some clustering algorithms and validity indices](#). *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 24(12), 1650-1654.
12. Xu, L. (1997). [Bayesian Ying-Yang machine, clustering and number of clusters](#). *Pattern Recognition Letters*, 18(11-13), 1167-1178.

Other links


- [Hierarchical agglomerative clustering - Stanford NLP Group](#)
- [Hierarchical clustering \(Wikipedia\)](#)
- [Complete linkage criterion \(Wikipedia\)](#)
- [Single linkage criterion \(Wikipedia\)](#)
- [Silhouette clustering \(Wikipedia\)](#)
- [Dunn index \(Wikipedia\)](#)
- [Davies-Bouldin index \(Wikipedia\)](#)
- [D3.js](#)

Aglomera Namespace



Classes

Class	Description
 AgglomerativeClusteringAlgorithm(TInstance)	Implements the agglomerative nesting clustering algorithm (program AGNES) in [1].
 CachedDissimilarityMetric(TInstance)	Represents a cache to store dissimilarities between all instances of a known set, as dictated by a base IDissimilarityMetric(TInstance) .
 Cluster(TInstance)	Represents a set of <i>TInstance</i> elements arranged in a hierarchical form.
 ClusteringResult(TInstance)	Represents the result of a clustering algorithm, consisting in the sequence of ClusterSet(TInstance) elements that were found during the agglomeration of all clusters.
 ClusterSet(TInstance)	Represents a set of Cluster(TInstance) elements that were found during the execution of the clustering algorithm separated at some minimum distance.
 Combinatorics	A utility class containing combinatorics methods.
 Extensions	Contains several extension utility methods.


Structures

Structure	Description
 ClusterSetEvaluation(TInstance)	Represents the result of evaluating some ClusterSet(TInstance) according to some criterion.

Interfaces

Interface	Description
 IClusteringAlgorithm(TInstance)	Represents an interface for hierarchical agglomerative clustering algorithms.
 IDissimilarityMetric(TInstance)	Represents an interface for metrics measuring the dissimilarity/distance between instances.

Delegates

	Delegate	Description
	CentroidFunction(TInstance)	Represents a delegate for functions calculating the centroids of Cluster(TInstance) objects, i.e., they calculate the representative element of a given cluster.

AgglomerativeClusteringAlgorithm(TInstance) Class

Implements the agglomerative nesting clustering algorithm (program AGNES) in [1].

Inheritance Hierarchy

[System.Object](#)

Agglomera.AgglomerativeClusteringAlgorithm(TInstance)

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

C#

```
public class AgglomerativeClusteringAlgorithm<TInstance> : IClusteringAlgorithm<TInstance>
where TInstance : Object, IComparable<TInstance>
```

[View Source](#)


Type Parameters

TInstance


The type of instance considered.

The AgglomerativeClusteringAlgorithm(TInstance) type exposes the following members.

Constructors








	Name	Description
	AgglomerativeClusteringAlgorithm(TInstance)	Creates a new instance of AgglomerativeClusteringAlgorithm(TInstance) with the given set of instances and linkage criterion.

Properties

	Name	Description
	LinkageCriterion	Gets the ILinkageCriterion(TInstance) used by this algorithm to create the clusters.

Methods

	Name	Description
	Equals	(Inherited from Object .)
	Finalize	(Inherited from Object .)

 GetClustering(ISet(TInstance))	Clusters the set of <i>TInstance</i> given to the algorithm.
 GetClustering(ClusterSet(TInstance))	Runs the clustering algorithm over the given ClusterSet(TInstance) .
 GetClustering(IEnumerable(Cluster(TInstance)), Double)	Runs the clustering algorithm over the set of given Cluster(TInstance) .
 GetHashCode	(Inherited from Object .)
 GetType	(Inherited from Object .)
 MemberwiseClone	(Inherited from Object .)
 ToString	(Inherited from Object .)

Remarks

[1] Kaufman, L., & Rousseeuw, P. J. (1990). Agglomerative nesting (program AGNES). Finding Groups in Data: An Introduction to Cluster Analysis, 199-252.

See Also

[Agglomera Namespace](#)

AgglomerativeClusteringAlgorithm(TInstance) Constructor

Creates a new instance of [AgglomerativeClusteringAlgorithm\(TInstance\)](#) with the given set of instances and linkage criterion.

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
public AgglomerativeClusteringAlgorithm(  
    ILinkageCriterion<TInstance> linkageCriterion  
)
```

[View Source](#)

Parameters

linkageCriterion

Type: [Agglomera.Linkage.ILinkageCriterion\(TInstance\)](#)

The criterion used to measure dissimilarities within and between clusters.

See Also

[AgglomerativeClusteringAlgorithm\(TInstance\)Class](#)

[Agglomera Namespace](#)

AgglomerativeClusteringAlgorithm(TInstance).AgglomerativeClusteringAlgorithm(TInstance) Properties

The [AgglomerativeClusteringAlgorithm\(TInstance\)](#) generic type exposes the following members.

Properties

	Name	Description
	LinkageCriterion	Gets the ILinkageCriterion(TInstance) used by this algorithm to create the clusters.

See Also

[AgglomerativeClusteringAlgorithm\(TInstance\)Class](#)

[Aglomera Namespace](#)

AgglomerativeClusteringAlgorithm(TInstance).LinkageCriterion Property

Gets the [ILinkageCriterion\(TInstance\)](#) used by this algorithm to create the clusters.

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
public ILinkageCriterion<TInstance> LinkageCriterion { get; }
```

[View Source](#)

Property Value

Type: [ILinkageCriterion\(TInstance\)](#)

Implements

[IClusteringAlgorithm\(TInstance\).LinkageCriterion](#)

See Also










[AgglomerativeClusteringAlgorithm\(TInstance\)Class](#)

[Agglomera Namespace](#)

AgglomerativeClusteringAlgorithm(TInstance).AgglomerativeClusteringAlgorithm(TInstance) Methods

The [AgglomerativeClusteringAlgorithm\(TInstance\)](#) generic type exposes the following members.

Methods




	Name	Description
	Equals	(Inherited from Object .)
	Finalize	(Inherited from Object .)
	GetClustering(ISet(TInstance))	Clusters the set of <i>TInstance</i> given to the algorithm.
	GetClustering(ClusterSet(TInstance))	Runs the clustering algorithm over the given ClusterSet(TInstance) .
	GetClustering(IEnumerable(Cluster(TInstance)), Double)	Runs the clustering algorithm over the set of given Cluster(TInstance) .
	GetHashCode	(Inherited from Object .)
	GetType	(Inherited from Object .)
	MemberwiseClone	(Inherited from Object .)
	ToString	(Inherited from Object .)

See Also

[AgglomerativeClusteringAlgorithm\(TInstance\)Class](#)

[Aglomera Namespace](#)

AgglomerativeClusteringAlgorithm(TInstance).GetClustering Method Overload List

	Name	Description
	GetClustering(ISet(TInstance))	Clusters the set of <i>TInstance</i> given to the algorithm.
	GetClustering(ClusterSet(TInstance))	Runs the clustering algorithm over the given ClusterSet(TInstance) .
	GetClustering(IEnumerable(Cluster(TInstance)), Double)	Runs the clustering algorithm over the set of given Cluster(TInstance) .

See Also

[AgglomerativeClusteringAlgorithm\(TInstance\)Class](#)

[Aglomera Namespace](#)

AgglomerativeClusteringAlgorithm(TInstance).GetClustering Method (ISet(TInstance))

Clusters the set of *TInstance* given to the algorithm.

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
public ClusteringResult<TInstance> GetClustering(  
    ISet<TInstance> instances  
)
```

[View Source](#)

Parameters

instances

Type: [System.Collections.Generic.ISet\(TInstance\)](#)

The instances to be clustered by the algorithm.

Return Value

Type: [ClusteringResult\(TInstance\)](#)

A [ClusteringResult\(TInstance\)](#) containing all the [ClusterSet\(TInstance\)](#) found in each step of the algorithm and the corresponding the dissimilarity/distance at which they were found.

Implements

[IClusteringAlgorithm\(TInstance\).GetClustering\(ISet\(TInstance\)\)](#)

See Also

[AgglomerativeClusteringAlgorithm\(TInstance\)Class](#)

[GetClustering Overload](#)

[Agglomera Namespace](#)

AgglomerativeClusteringAlgorithm(TInstance).GetClustering Method (ClusterSet(TInstance))

Runs the clustering algorithm over the given [ClusterSet\(TInstance\)](#).

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
public ClusteringResult<TInstance> GetClustering(  
    ClusterSet<TInstance> clusterSet  
)
```

[View Source](#)

Parameters

clusterSet

Type: [Agglomera.ClusterSet\(TInstance\)](#)

The initial clusters and dissimilarity provided to the algorithm.

Return Value

Type: [ClusteringResult\(TInstance\)](#)

A [ClusteringResult\(TInstance\)](#) containing all the [ClusterSet\(TInstance\)](#) found in each step of the algorithm and the corresponding the dissimilarity/distance at which they were found.

Implements

[IClusteringAlgorithm\(TInstance\).GetClustering\(ClusterSet\(TInstance\)\)](#)

See Also

[AgglomerativeClusteringAlgorithm\(TInstance\)Class](#)

[GetClustering Overload](#)

[Agglomera Namespace](#)

AgglomerativeClusteringAlgorithm(TInstance).GetClustering Method (IEnumerable(Cluster(TInstance)), Double)

Runs the clustering algorithm over the set of given [Cluster\(TInstance\)](#).

Namespace: [Aglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
public ClusteringResult<TInstance> GetClustering(  
    IEnumerable<Cluster<TInstance>> clusters,  
    double dissimilarity = 0  
)
```

[View Source](#)

Parameters

clusters

Type: [System.Collections.Generic.IEnumerable\(Cluster\(TInstance\)\)](#)

The initial clusters provided to the algorithm.

dissimilarity (Optional)

Type: [System.Double](#)

The initial dissimilarity associated with the given clusters.

Return Value

Type: [ClusteringResult\(TInstance\)](#)

A [ClusteringResult\(TInstance\)](#) containing all the [ClusterSet\(TInstance\)](#) found in each step of the algorithm and the corresponding the dissimilarity/distance at which they were found.

Implements

[IClusteringAlgorithm\(TInstance\).GetClustering\(IEnumerable\(Cluster\(TInstance\)\), Double\)](#)

See Also

[AgglomerativeClusteringAlgorithm\(TInstance\)Class](#)

[GetClustering Overload](#)

[Aglomera Namespace](#)

CachedDissimilarityMetric(TInstance) Class

Represents a cache to store dissimilarities between all instances of a known set, as dictated by a base [IDissimilarityMetric\(TInstance\)](#).

Inheritance Hierarchy

[System.Object](#)

Aglomera.CachedDissimilarityMetric(TInstance)

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public class CachedDissimilarityMetric<TInstance> : IDissimilarityMetric<TInstance>,  
    IDisposable
```


[View Source](#)

Type Parameters









TInstance

The CachedDissimilarityMetric(TInstance) type exposes the following members.

Constructors

	Name	Description
	CachedDissimilarityMetric(TInstance)	Creates a new CachedDissimilarityMetric(TInstance) according to the given base dissimilarity metric and the known set of instances.

Methods

	Name	Description
	Calculate	Calculates the distance between two instances according to this metric.
	Dispose	Releases all resources used by the CachedDissimilarityMetric(TInstance)
	Equals	(Inherited from Object .)
	Finalize	(Inherited from Object .)
	GetHashCode	(Inherited from Object .)
	GetType	(Inherited from Object .)
	MemberwiseClone	(Inherited from Object .)
	ToString	(Inherited from Object .)

Remarks

This class is useful to use during the execution of [AgglomerativeClusteringAlgorithm\(TInstance\)](#) as many [ILinkageCriterion\(TInstance\)](#) classes rely on pair-wise dissimilarities between the instances. In that sense, the set of instances has to be known beforehand and must not change and no verification is done in [Calculate\(TInstance, TInstance\)](#). This means that if cluster centroids are used to measure dissimilarities, they have to be included in the original set, otherwise the value will not be present in the cache.

See Also

[Aglomera Namespace](#)

CachedDissimilarityMetric(TInstance) Constructor

Creates a new [CachedDissimilarityMetric\(TInstance\)](#) according to the given base dissimilarity metric and the known set of instances.

Namespace: [Aglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public CachedDissimilarityMetric(  
    IDissimilarityMetric<TInstance> dissimilarityMeasure,  
    ISet<TInstance> allInstances  
)
```

[View Source](#)

Parameters

dissimilarityMeasure

Type: [Aglomera.IDissimilarityMetric\(TInstance\)](#)

The metric to be used to cache the dissimilarities between all instances.

allInstances

Type: [System.Collections.Generic.ISet\(TInstance\)](#)

The set of instances for which to calculate the pair-wise dissimilarities.

See Also









[CachedDissimilarityMetric\(TInstance\)Class](#)

[Aglomera Namespace](#)

CachedDissimilarityMetric(TInstance).CachedDissimilarityMetric(TInstance) Methods

The [CachedDissimilarityMetric\(TInstance\)](#) generic type exposes the following members.

Methods

	Name	Description
	Calculate	Calculates the distance between two instances according to this metric.
	Dispose	
	Equals	(Inherited from Object .)
	Finalize	(Inherited from Object .)
	GetHashCode	(Inherited from Object .)
	GetType	(Inherited from Object .)
	MemberwiseClone	(Inherited from Object .)
	ToString	(Inherited from Object .)

See Also

[CachedDissimilarityMetric\(TInstance\) Class](#)

[Agglomera Namespace](#)

CachedDissimilarityMetric(TInstance).Calculate Method

Calculates the distance between two instances according to this metric.

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public double Calculate(  
    TInstance instance1,  
    TInstance instance2  
)
```

[View Source](#)

Parameters

instance1

Type: *TInstance*

The first instance.

instance2

Type: *TInstance*

The second instance.

Return Value

Type: [Double](#)

A value representing the distance between two instances according to this metric.

Implements

[IDissimilarityMetric\(TInstance\).Calculate\(TInstance, TInstance\)](#)

See Also

[CachedDissimilarityMetric\(TInstance\)Class](#)

[Agglomera Namespace](#)

CachedDissimilarityMetric(TInstance).Dispose Method

Releases all resources used by the [CachedDissimilarityMetric\(TInstance\)](#)

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

C#

```
public void Dispose()
```

[View Source](#)

Implements

[IDisposable.Dispose\(\)](#)

See Also

[CachedDissimilarityMetric\(TInstance\)Class](#)

[Agglomera Namespace](#)

CentroidFunction(TInstance) Delegate

Represents a delegate for functions calculating the centroids of [Cluster\(TInstance\)](#) objects, i.e., they calculate the representative element of a given cluster.

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public delegate TInstance CentroidFunction<TInstance>(  
    Cluster<TInstance> cluster  
)  
where TInstance : Object, IComparable<TInstance>
```

Parameters

cluster

Type: [Agglomera.Cluster\(TInstance\)](#)

The cluster whose representative we want to retrieve.

Type Parameters

TInstance

The type of instance considered.

Return Value

Type: **TInstance**

The representative of the given cluster according to some criterion defined by this function.

See Also

[Agglomera Namespace](#)

Cluster(TInstance) Class

Represents a set of *TInstance* elements arranged in a hierarchical form.

Inheritance Hierarchy

[System.Object](#)

Aglomera.Cluster(TInstance)

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

C#

```
public class Cluster<TInstance> : IEnumerable<TInstance>,
    IEnumerable, IEquatable<Cluster<TInstance>>, IComparable<Cluster<TInstance>>
where TInstance : Object, IComparable<TInstance>
```

[View Source](#)





Type Parameters

TInstance



The type of instance considered.



The Cluster(TInstance) type exposes the following members.

Constructors












	Name	Description
	Cluster(TInstance)(Cluster(TInstance))	Creates a new Cluster(TInstance) which is an exact copy of the given cluster.
	Cluster(TInstance)(IEnumerable(TInstance), Double)	Creates a new Cluster(TInstance) with the given <i>TInstance</i> elements.
	Cluster(TInstance)(TInstance, Double)	Creates a new Cluster(TInstance) with a single <i>TInstance</i> element.
	Cluster(TInstance)(Cluster(TInstance), Cluster(TInstance), Double)	Creates a new Cluster(TInstance) by joining the two given clusters.

Properties


	Name	Description
	Count	Gets the number of elements in this cluster.
	Dissimilarity	Gets the dissimilarity / distance at which this cluster was found by the clustering algorithm.

	Parent1	Gets this cluster's first parent, if the cluster was formed by joining two existing clusters. Otherwise returns <code>null</code> .
	Parent2	Gets this cluster's second parent, if the cluster was formed by joining two existing clusters. Otherwise returns <code>null</code> .


Methods

	Name	Description
	Clone	Creates a new <code>Cluster(TInstance)</code> which is an exact copy of this cluster.
	CompareTo	Compares this cluster with another cluster instance. Comparison is performed by count (number of items) first, then by string representation of the items.
	Contains	Checks whether this cluster contains the given item.
	Equals(Object)	(Overrides Object.Equals(Object) .)
	Equals(Cluster(TInstance))	Checks whether this cluster is equal to another. Equality between cluster occurs when they are the same object or when the clusters contain the same elements, were created based on the same parent clusters and have the same associated dissimilarity.
	Finalize	(Inherited from Object .)
	GetEnumerator	
	GetHashCode	(Overrides Object.GetHashCode() .)
	GetType	(Inherited from Object .)
	MemberwiseClone	(Inherited from Object .)
	ToString	Gets a string representing this cluster in the form (item1;item2;...;itemN). (Overrides Object.ToString() .)

Fields

	Name	Description
	Empty	Gets an empty cluster.

Extension Methods





	Name	Description
	GetMedoid(TInstance)	Returns the medoid of a given <code>Cluster(TInstance)</code> , i.e., a representative object whose dissimilarity to all the instances in the cluster is minimal. (Defined by Extensions .)

See Also

[Agglomera Namespace](#)

Cluster(TInstance) Constructor

Overload List

	Name	Description
	Cluster(TInstance)(Cluster(TInstance))	Creates a new Cluster(TInstance) which is an exact copy of the given cluster.
	Cluster(TInstance)(IEnumerable(TInstance), Double)	Creates a new Cluster(TInstance) with the given <i>TInstance</i> elements.
	Cluster(TInstance)(TInstance, Double)	Creates a new Cluster(TInstance) with a single <i>TInstance</i> element.
	Cluster(TInstance)(Cluster(TInstance), Cluster(TInstance), Double)	Creates a new Cluster(TInstance) by joining the two given clusters.

See Also

[Cluster\(TInstance\)Class](#)

[Agglomera Namespace](#)

Cluster(TInstance) Constructor (Cluster(TInstance))

Creates a new [Cluster\(TInstance\)](#) which is an exact copy of the given cluster.

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public Cluster(  
    Cluster<TInstance> cluster  
)
```

[View Source](#)

Parameters

cluster

Type: [Agglomera.Cluster\(TInstance\)](#)

The cluster to be copied into the new cluster.

See Also

[Cluster\(TInstance\)Class](#)

[Cluster\(TInstance\)Overload](#)

[Aglomera Namespace](#)

Cluster(TInstance) Constructor (IEnumerable(TInstance), Double)

Creates a new [Cluster\(TInstance\)](#) with the given *TInstance* elements.

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public Cluster(  
    IEnumerable<TInstance> instances,  
    double dissimilarity = 0  
)
```

[View Source](#)

Parameters

instances

Type: [System.Collections.Generic.IEnumerable\(TInstance\)](#)

The elements in the new cluster.

dissimilarity (Optional)

Type: [System.Double](#)

The dissimilarity/distance at which the new cluster was found.

See Also

[Cluster\(TInstance\)Class](#)

[Cluster\(TInstance\)Overload](#)

[Aglomera Namespace](#)

Cluster(*TInstance*) Constructor (*TInstance*, Double)

Creates a new [Cluster\(*TInstance*\)](#) with a single *TInstance* element.

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public Cluster(  
    TInstance instance,  
    double dissimilarity = 0  
)
```

[View Source](#)

Parameters

instance

Type: *TInstance*

The single element in the new cluster.

dissimilarity (Optional)

Type: [System.Double](#)

The dissimilarity/distance at which the new cluster was found.

See Also

[Cluster\(*TInstance*\)Class](#)

[Cluster\(*TInstance*\)Overload](#)

[Aglomera Namespace](#)

Cluster(TInstance) Constructor (Cluster(TInstance), Cluster(TInstance), Double)

Creates a new [Cluster\(TInstance\)](#) by joining the two given clusters.

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
public Cluster(  
    Cluster<TInstance> parent1,  
    Cluster<TInstance> parent2,  
    double dissimilarity  
)
```

[View Source](#)

Parameters

parent1

Type: [Agglomera.Cluster\(TInstance\)](#)

The first parent of the new cluster.

parent2

Type: [Agglomera.Cluster\(TInstance\)](#)

The second parent of the new cluster.

dissimilarity

Type: [System.Double](#)

The dissimilarity/distance at which the new cluster was found.

See Also

[Cluster\(TInstance\)Class](#)





[Cluster\(TInstance\)Overload](#)

[Agglomera Namespace](#)

Cluster(TInstance).Cluster(TInstance) Properties

The [Cluster\(TInstance\)](#) generic type exposes the following members.

Properties

	Name	Description
	Count	Gets the number of elements in this cluster.
	Dissimilarity	Gets the dissimilarity / distance at which this cluster was found by the clustering algorithm.
	Parent1	Gets this cluster's first parent, if the cluster was formed by joining two existing clusters. Otherwise returns <code>null</code> .
	Parent2	Gets this cluster's second parent, if the cluster was formed by joining two existing clusters. Otherwise returns <code>null</code> .

See Also

[Cluster\(TInstance\)Class](#)

[Agglomera Namespace](#)

Cluster(TInstance).Count Property

Gets the number of elements in this cluster.

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

C#

```
public int Count { get; }
```

[View Source](#)

Property Value

Type: [Int32](#)

See Also

[Cluster\(TInstance\)Class](#)

[Aglomera Namespace](#)

Cluster(TInstance).Dissimilarity Property

Gets the dissimilarity / distance at which this cluster was found by the clustering algorithm.

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

C#

```
public double Dissimilarity { get; }
```

[View Source](#)

Property Value

Type: [Double](#)

See Also

[Cluster\(TInstance\)Class](#)

[Aglomera Namespace](#)

Cluster(TInstance).Parent1 Property

Gets this cluster's first parent, if the cluster was formed by joining two existing clusters. Otherwise returns `null`.

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

C#

```
public Cluster<TInstance> Parent1 { get; }
```

[View Source](#)

Property Value

Type: [Cluster\(TInstance\)](#)

See Also

[Cluster\(TInstance\)Class](#)

[Agglomera Namespace](#)

Cluster(TInstance).Parent2 Property

Gets this cluster's second parent, if the cluster was formed by joining two existing clusters. Otherwise returns `null`.

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
public Cluster<TInstance> Parent2 { get; }
```

[View Source](#)

Property Value

Type: [Cluster\(TInstance\)](#)

See Also












[Cluster\(TInstance\)Class](#)

[Agglomera Namespace](#)


Cluster(TInstance).Cluster(TInstance) Methods

The [Cluster\(TInstance\)](#) generic type exposes the following members.

Methods

Name	Description
 Clone	Creates a new Cluster(TInstance) which is an exact copy of this cluster.
 CompareTo	Compares this cluster with another cluster instance. Comparison is performed by count (number of items) first, then by string representation of the items.
 Contains	Checks whether this cluster contains the given item.
 Equals(Object)	(Overrides Object.Equals(Object) .)
 Equals(Cluster(TInstance))	Checks whether this cluster is equal to another. Equality between cluster occurs when they are the same object or when the clusters contain the same elements, were created based on the same parent clusters and have the same associated dissimilarity.
 Finalize	(Inherited from Object .)
 GetEnumerator	
 GetHashCode	(Overrides Object.GetHashCode() .)
 GetType	(Inherited from Object .)
 MemberwiseClone	(Inherited from Object .)
 ToString	Gets a string representing this cluster in the form (item1;item2;...;itemN). (Overrides Object.ToString() .)

Extension Methods

Name	Description
 GetMedoid(TInstance)	Returns the medoid of a given Cluster(TInstance) , i.e., a representative object whose dissimilarity to all the instances in the cluster is minimal. (Defined by Extensions .)

See Also

[Cluster\(TInstance\)Class](#)

[Agglomera Namespace](#)

Cluster(TInstance).Clone Method

Creates a new [Cluster\(TInstance\)](#) which is an exact copy of this cluster.

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

C#

```
public Cluster<TInstance> Clone()
```

[View Source](#)

Return Value

Type: [Cluster\(TInstance\)](#)

A new [Cluster\(TInstance\)](#) which is an exact copy of this cluster.

See Also

[Cluster\(TInstance\)Class](#)

[Agglomera Namespace](#)

Cluster(TInstance).CompareTo Method

Compares this cluster with another cluster instance. Comparison is performed by count (number of items) first, then by string representation of the items.

Namespace: [Aglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public int CompareTo(  
    Cluster<TInstance> other  
)
```

[View Source](#)

Parameters

other

Type: [Aglomera.Cluster\(TInstance\)](#)

The cluster to compare to.

Return Value

Type: [Int32](#)

-1 if *other* is null, the result of [Count](#) comparison between the clusters, or the result of `string.CompareOrdinal` if the clusters have the same count.

Implements

[IComparable\(T\).CompareTo\(T\)](#)

See Also

[Cluster\(TInstance\) Class](#)

[Aglomera Namespace](#)

Cluster(TInstance).Contains Method

Checks whether this cluster contains the given item.

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

C#

```
public bool Contains(  
    TInstance item  
)
```

[View Source](#)

Parameters

item

Type: *TInstance*

The item whose presence in the cluster we want to check.

Return Value

Type: [Boolean](#)

true if the cluster contains the given item, **false** otherwise.



See Also

[Cluster\(TInstance\) Class](#)

[Agglomera Namespace](#)

Cluster(TInstance).Equals Method

Overload List

	Name	Description
	Equals(Object)	(Overrides Object.Equals(Object) .)
	Equals(Cluster(TInstance))	Checks whether this cluster is equal to another. Equality between cluster occurs when they are the same object or when the clusters contain the same elements, were created based on the same parent clusters and have the same associated dissimilarity.

See Also

[Cluster\(TInstance\)Class](#)

[Agglomera Namespace](#)

Cluster(TInstance).Equals Method (Object)

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public override bool Equals(  
    Object other  
)
```

[View Source](#)

Parameters

other

Type: [System.Object](#)

[Missing <param name="other"/> documentation for "M:Aglomera.Cluster`1.Equals(System.Object)"]

Return Value

Type: [Boolean](#)

See Also

[Cluster\(TInstance\)Class](#)

[Equals Overload](#)

[Aglomera Namespace](#)

Cluster(TInstance).Equals Method (Cluster(TInstance))

Checks whether this cluster is equal to another. Equality between cluster occurs when they are the same object or when the clusters contain the same elements, were created based on the same parent clusters and have the same associated dissimilarity.

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
public bool Equals(  
    Cluster<TInstance> other  
)
```

[View Source](#)

Parameters

other

Type: [Agglomera.Cluster\(TInstance\)](#)

The other cluster to verify equality.

Return Value

Type: [Boolean](#)

true if the clusters are equal, false otherwise.

Implements

[IEquatable\(T\).Equals\(T\)](#)

See Also

[Cluster\(TInstance\)Class](#)

[Equals Overload](#)

[Aglomera Namespace](#)

Cluster(TInstance).GetEnumerator Method

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
public IEnumerator<TInstance> GetEnumerator()
```

[View Source](#)

Return Value

Type: [IEnumerator](#)(TInstance)

Implements

[IEnumerable\(T\).GetEnumerator\(\)](#)

See Also

[Cluster\(TInstance\)Class](#)

[Aglomera Namespace](#)

Cluster(TInstance).GetHashCode Method

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

C#

```
public override int GetHashCode()
```

[View Source](#)

Return Value

Type: [Int32](#)

See Also

[Cluster\(TInstance\) Class](#)

[Agglomera Namespace](#)

Cluster(TInstance).ToString Method

Gets a string representing this cluster in the form (item1;item2;...;itemN).

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

C#

```
public override string ToString()
```

[View Source](#)

Return Value

Type: [String](#)

A string representing the cluster.

See Also


[Cluster\(TInstance\)Class](#)

[Agglomera Namespace](#)

Cluster(TInstance).Cluster(TInstance) Fields

The [Cluster\(TInstance\)](#) generic type exposes the following members.

Fields

	Name	Description
	Empty	Gets an empty cluster.

See Also

[Cluster\(TInstance\) Class](#)

[Agglomera Namespace](#)

Cluster(TInstance).Empty Field

Gets an empty cluster.

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

C#

```
public static readonly Cluster<TInstance> Empty
```

[View Source](#)

Field Value

Type: [Cluster\(TInstance\)](#)

See Also

[Cluster\(TInstance\)Class](#)

[Aglomera Namespace](#)

ClusteringResult(TInstance) Class

Represents the result of a clustering algorithm, consisting in the sequence of [ClusterSet\(TInstance\)](#) elements that were found during the agglomeration of all clusters.

Inheritance Hierarchy

[System.Object](#)

Aglomera.ClusteringResult(TInstance)

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
public class ClusteringResult<TInstance> : IEnumerable<ClusterSet<TInstance>>,  
    IEnumerable  
where TInstance : Object, IComparable<TInstance>
```

[View Source](#)


Type Parameters

TInstance




The type of instance considered.

The ClusteringResult(TInstance) type exposes the following members.



Constructors







	Name	Description
	ClusteringResult(TInstance)	Creates a new ClusteringResult(TInstance) of the given size.

Properties





	Name	Description
	Count	Gets the number of ClusterSet(TInstance) found by the algorithm.
	Item	Gets or sets the ClusterSet(TInstance) at the given index of the sequence.
	SingleCluster	Gets the Cluster(TInstance) corresponding to the agglomeration of all the <i>TInstance</i> elements considered by the algorithm.


Methods

	Name	Description
	Equals	(Inherited from Object .)
	Finalize	(Inherited from Object .)

	GetEnumerator	
	GetHashCode	(Inherited from Object .)
	GetType	(Inherited from Object .)
	MemberwiseClone	(Inherited from Object .)
	SaveToCsv	Saves the ClusterSet(TInstance) objects stored in this ClusteringResult(TInstance) in a comma-separated values (CSV) file.
	ToString	(Inherited from Object .)

Extension Methods

Name	Description
 EvaluateClustering(TInstance)(IInternalEvaluationCriterion(TInstance))	Overloaded. Evaluates all given ClusterSet(TInstance) s according to the given IInternalEvaluationCriterion(TInstance) . The maximum number of clusters allowed in a cluster-set for it to be evaluated corresponds to $\sqrt{N/2}$, where N is the total number of instances clustered. (Defined by Extensions .)
 EvaluateClustering(TInstance)(IInternalEvaluationCriterion(TInstance), UInt32)	Overloaded. Evaluates all given ClusterSet(TInstance) s according to the given IInternalEvaluationCriterion(TInstance) . (Defined by Extensions .)
 EvaluateClustering(TInstance, TClass)(IExternalEvaluationCriterion(TInstance, TClass), IDictionary(TInstance, TClass))	Overloaded. Evaluates all given ClusterSet(TInstance) s according to the given IExternalEvaluationCriterion(TInstance, TClass) . The maximum number of clusters allowed in a cluster-set for it to be evaluated corresponds to $\sqrt{N/2}$, where N is the total number of instances clustered. (Defined by Extensions .)
 EvaluateClustering(TInstance, TClass)(IExternalEvaluationCriterion(TInstance, TClass), IDictionary(TInstance, TClass), UInt32)	Overloaded. Evaluates all given ClusterSet(TInstance) s according to the given IExternalEvaluationCriterion(TInstance, TClass) . (Defined by Extensions .)

 SaveD3DendrogramFile(TInstance)	Saves the given ClusteringResult(TInstance) to a d3.js dendrogram file. (Defined by D3Extensions.)
---	---

See Also

[Agglomera Namespace](#)

ClusteringResult(TInstance) Constructor

Creates a new [ClusteringResult\(TInstance\)](#) of the given size.

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
public ClusteringResult(  
    int size  
)
```

[View Source](#)

Parameters

size

Type: [System.Int32](#)

The maximum number of [ClusterSet\(TInstance\)](#) to be added by the algorithm.

See Also




[ClusteringResult\(TInstance\)Class](#)

[Agglomera Namespace](#)

ClusteringResult(TInstance).ClusteringResult(TInstance) Properties

The [ClusteringResult\(TInstance\)](#) generic type exposes the following members.

Properties

	Name	Description
	Count	Gets the number of ClusterSet(TInstance) found by the algorithm.
	Item	Gets or sets the ClusterSet(TInstance) at the given index of the sequence.
	SingleCluster	Gets the Cluster(TInstance) corresponding to the agglomeration of all the <i>TInstance</i> elements considered by the algorithm.

See Also

[ClusteringResult\(TInstance\)Class](#)

[Agglomera Namespace](#)

ClusteringResult(TInstance).Count Property

Gets the number of [ClusterSet\(TInstance\)](#) found by the algorithm.

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

C#

```
public int Count { get; }
```

[View Source](#)

Property Value

Type: [Int32](#)

See Also

[ClusteringResult\(TInstance\)Class](#)

[Aglomera Namespace](#)

ClusteringResult(TInstance).Item Property

Gets or sets the [ClusterSet\(TInstance\)](#) at the given index of the sequence.

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
public ClusterSet<TInstance> this[  
    int index  
{ get; set; }
```

[View Source](#)

Parameters

index

Type: [System.Int32](#)

The index of the cluster set we want to get or set.

Return Value

Type: [ClusterSet\(TInstance\)](#)

The [ClusterSet\(TInstance\)](#) at the given index of the sequence.

See Also

[ClusteringResult\(TInstance\) Class](#)

[Agglomera Namespace](#)

ClusteringResult(TInstance).SingleCluster Property

Gets the [Cluster\(TInstance\)](#) corresponding to the agglomeration of all the *TInstance* elements considered by the algorithm.

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

C#

```
public Cluster<TInstance> SingleCluster { get; }
```

[View Source](#)

Property Value

Type: [Cluster\(TInstance\)](#)

See Also









[ClusteringResult\(TInstance\)Class](#)

[Agglomera Namespace](#)




ClusteringResult(TInstance).ClusteringResult(TInstance) Methods



The [ClusteringResult\(TInstance\)](#) generic type exposes the following members.

Methods

Name	Description
 Equals	(Inherited from Object .)
 Finalize	(Inherited from Object .)
 GetEnumerator	
 GetHashCode	(Inherited from Object .)
 GetType	(Inherited from Object .)
 MemberwiseClone	(Inherited from Object .)
 SaveToCsv	Saves the ClusterSet(TInstance) objects stored in this ClusteringResult(TInstance) in a comma-separated values (CSV) file.
 ToString	(Inherited from Object .)

Extension Methods

Name	Description
 EvaluateClustering(TInstance)(IInternalEvaluationCriterion(TInstance))	Overloaded. Evaluates all given ClusterSet(TInstance) s according to the given IInternalEvaluationCriterion(TInstance) . The maximum number of clusters allowed in a cluster-set for it to be evaluated corresponds to $\sqrt{N/2}$, where N is the total number of instances clustered. (Defined by Extensions .)
 EvaluateClustering(TInstance)(IInternalEvaluationCriterion(TInstance), UInt32)	Overloaded. Evaluates all given ClusterSet(TInstance) s according to the given IInternalEvaluationCriterion(TInstance) . (Defined by Extensions .)
 EvaluateClustering(TInstance, TClass)(IExternalEvaluationCriterion(TInstance, TClass), IDictionary(TInstance, TClass))	Overloaded. Evaluates all given ClusterSet(TInstance) s according to the given IExternalEvaluationCriterion(TInstance, TClass) . The maximum number of clusters allowed in a cluster-set for it to be evaluated corresponds to $\sqrt{N/2}$, where N is the total number of instances

		clustered. (Defined by Extensions.)
	EvaluateClustering(TInstance, TClass)(IExternalEvaluationCriterion(TInstance, TClass), IDictionary(TInstance, TClass), UInt32)	Overloaded. Evaluates all given ClusterSet(TInstance) s according to the given IExternalEvaluationCriterion(TInstance, TClass) . (Defined by Extensions.)
	SaveD3DendrogramFile(TInstance)	Saves the given ClusteringResult(TInstance) to a d3.js dendrogram file. (Defined by D3Extensions.)

See Also

[ClusteringResult\(TInstance\)Class](#)

[Agglomera Namespace](#)

ClusteringResult(TInstance).GetEnumerator Method

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
public IEnumerator<ClusterSet<TInstance>> GetEnumerator()
```

[View Source](#)

Return Value

Type: [IEnumerator](#)([ClusterSet](#)([TInstance](#)))

Implements

[IEnumerable](#)([T](#)).GetEnumerator()

See Also

[ClusteringResult\(TInstance\) Class](#)

[Agglomera Namespace](#)

ClusteringResult(TInstance).SaveToCsv Method

Saves the [ClusterSet\(TInstance\)](#) objects stored in this [ClusteringResult\(TInstance\)](#) in a comma-separated values (CSV) file.

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public void SaveToCsv(  
    string filePath,  
    char sepChar = ','  
)
```

[View Source](#)

Parameters

filePath

Type: [System.String](#)

The path to the file in which to save the clustering results.

sepChar (Optional)

Type: [System.Char](#)

The character used to separate the fields in the CSV file.

See Also

[ClusteringResult\(TInstance\)Class](#)

[Aglomera Namespace](#)

ClusterSet(TInstance) Class

Represents a set of [Cluster\(TInstance\)](#) elements that were found during the execution of the clustering algorithm separated at some minimum distance.

Inheritance Hierarchy

[System.Object](#)

Aglomera.ClusterSet(TInstance)

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

C#
<pre>public class ClusterSet<TInstance> : IEnumerable<Cluster<TInstance>>, IEnumerable where TInstance : Object, IComparable<TInstance></pre>

[View Source](#)


Type Parameters

TInstance




The type of instance considered.

The ClusterSet(TInstance) type exposes the following members.




Constructors






	Name	Description
	ClusterSet(TInstance)	Creates a new ClusterSet(TInstance) with the given clusters and distance.

Properties

	Name	Description
	Count	Gets the number of clusters.
	Dissimilarity	The minimum dissimilarity/distance at which the clusters were found.
	Item	Gets the cluster at the give index.

Methods

	Name	Description
	Equals	(Inherited from Object .)
	Finalize	(Inherited from Object .)
	GetEnumerator	

	GetHashCode	(Inherited from Object .)
	GetType	(Inherited from Object .)
	MemberwiseClone	(Inherited from Object .)
	ToString()	Returns a string representation for the cluster-set in the form 'Dissimilarity {cluster1, cluster2, ..., clusterN}'. (Overrides Object.ToString() .)
	ToString(Boolean)	Returns a string representation for the cluster-set in the form 'Dissimilarity {cluster1, cluster2, ..., clusterN}'. The presentation of the dissimilarity value is optional.

See Also

[Agglomera Namespace](#)

ClusterSet(TInstance) Constructor

Creates a new [ClusterSet\(TInstance\)](#) with the given clusters and distance.

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public ClusterSet(  
    Cluster<TInstance>[] clusters,  
    double dissimilarity = 0  
)
```

[View Source](#)

Parameters

clusters

Type: [Agglomera.Cluster\(TInstance\)](#)[]

The set of clusters.

dissimilarity (Optional)

Type: [System.Double](#)

The dissimilarity/distance at which the clusters were found.

See Also




[ClusterSet\(TInstance\)Class](#)

[Aglomera Namespace](#)

ClusterSet(TInstance).ClusterSet(TInstance) Properties

The [ClusterSet\(TInstance\)](#) generic type exposes the following members.

Properties

	Name	Description
	Count	Gets the number of clusters.
	Dissimilarity	The minimum dissimilarity/distance at which the clusters were found.
	Item	Gets the cluster at the give index.

See Also

[ClusterSet\(TInstance\)Class](#)

[Agglomera Namespace](#)

ClusterSet(TInstance).Count Property

Gets the number of clusters.

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

C#

```
public int Count { get; }
```

[View Source](#)

Property Value

Type: [Int32](#)

See Also

[ClusterSet\(TInstance\)Class](#)

[Aglomera Namespace](#)

ClusterSet(TInstance).Dissimilarity Property

The minimum dissimilarity/distance at which the clusters were found.

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

C#

```
public double Dissimilarity { get; }
```

[View Source](#)

Property Value

Type: [Double](#)

See Also

[ClusterSet\(TInstance\)Class](#)

[Aglomera Namespace](#)

ClusterSet(TInstance).Item Property

Gets the cluster at the give index.

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
public Cluster<TInstance> this[  
    int index  
{ get; }
```

[View Source](#)

Parameters

index

Type: [System.Int32](#)

Property Value

Type: [Cluster](#)(TInstance)

See Also









[ClusterSet\(TInstance\)Class](#)

[Aglomera Namespace](#)

ClusterSet(TInstance).ClusterSet(TInstance) Methods

The [ClusterSet\(TInstance\)](#) generic type exposes the following members.

Methods

	Name	Description
	Equals	(Inherited from Object .)
	Finalize	(Inherited from Object .)
	GetEnumerator	
	GetHashCode	(Inherited from Object .)
	GetType	(Inherited from Object .)
	MemberwiseClone	(Inherited from Object .)
	ToString()	Returns a string representation for the cluster-set in the form 'Dissimilarity {cluster1, cluster2, ..., clusterN}'. (Overrides Object.ToString() .)
	ToString(Boolean)	Returns a string representation for the cluster-set in the form 'Dissimilarity {cluster1, cluster2, ..., clusterN}'. The presentation of the dissimilarity value is optional.

See Also

[ClusterSet\(TInstance\)Class](#)

[Agglomera Namespace](#)

ClusterSet(TInstance).GetEnumerator Method

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
public IEnumerator<Cluster<TInstance>> GetEnumerator()
```

[View Source](#)

Return Value

Type: [IEnumerator](#)([Cluster](#)(TInstance))

Implements

[IEnumerable\(T\).GetEnumerator\(\)](#)



See Also

[ClusterSet\(TInstance\)Class](#)

[Agglomera Namespace](#)

ClusterSet(TInstance).ToString Method

Overload List

	Name	Description
	ToString()	Returns a string representation for the cluster-set in the form 'Dissimilarity {cluster1, cluster2, ..., clusterN}'. (Overrides Object.ToString() .)
	ToString(Boolean)	Returns a string representation for the cluster-set in the form 'Dissimilarity {cluster1, cluster2, ..., clusterN}'. The presentation of the dissimilarity value is optional.

See Also

[ClusterSet\(TInstance\) Class](#)

[Agglomera Namespace](#)

ClusterSet(TInstance).ToString Method

Returns a string representation for the cluster-set in the form 'Dissimilarity {cluster1, cluster2, ..., clusterN}'.

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

C#

```
public override string ToString()
```

[View Source](#)

Return Value

Type: [String](#)

A string representation for the cluster-set.

See Also

[ClusterSet\(TInstance\)Class](#)

[ToString Overload](#)

[Aglomera Namespace](#)

ClusterSet(TInstance).ToString Method (Boolean)

Returns a string representation for the cluster-set in the form 'Dissimilarity {cluster1, cluster2, ..., clusterN}'. The presentation of the dissimilarity value is optional.

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public string ToString(  
    bool includeDissimilarity  
)
```

[View Source](#)

Parameters

includeDissimilarity

Type: [System.Boolean](#)

Whether to include the value of [Dissimilarity](#) in the string representation.

Return Value

Type: [String](#)

A string representation for the cluster-set.

See Also

[ClusterSet\(TInstance\)Class](#)

[ToString Overload](#)

[Agglomera Namespace](#)

ClusterSetEvaluation(TInstance) Structure

Represents the result of evaluating some [ClusterSet\(TInstance\)](#) according to some criterion.

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

C#

```
public struct ClusterSetEvaluation<TInstance>  
where TInstance : Object, IComparable<TInstance>
```

[View Source](#)


Type Parameters

TInstance



The type of instance considered.

The ClusterSetEvaluation(TInstance) type exposes the following members.





Constructors

	Name	Description
	ClusterSetEvaluation(TInstance)	Creates a new ClusterSetEvaluation(TInstance).

Properties

	Name	Description
	ClusterSet	Gets the cluster-set that was evaluated.
	EvaluationValue	Gets the value of the evaluation.

Methods

	Name	Description
	Equals	(Inherited from ValueType .)
	GetHashCode	(Inherited from ValueType .)
	GetType	(Inherited from Object .)
	ToString	(Overrides ValueType.ToString() .)

See Also

[Agglomera Namespace](#)

ClusterSetEvaluation(TInstance) Constructor

Creates a new [ClusterSetEvaluation\(TInstance\)](#).

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public ClusterSetEvaluation(  
    ClusterSet<TInstance> clusterSet,  
    double evaluationValue  
)
```

[View Source](#)

Parameters

clusterSet

Type: [Agglomera.ClusterSet\(TInstance\)](#)

The cluster-set that was evaluated.

evaluationValue

Type: [System.Double](#)

The value of the evaluation.

See Also



[ClusterSetEvaluation\(TInstance\)Structure](#)

[Agglomera Namespace](#)

ClusterSetEvaluation(TInstance).ClusterSetEvaluation(TInstance) Properties

The [ClusterSetEvaluation\(TInstance\)](#) generic type exposes the following members.

Properties

	Name	Description
	ClusterSet	Gets the cluster-set that was evaluated.
	EvaluationValue	Gets the value of the evaluation.

See Also

[ClusterSetEvaluation\(TInstance\)Structure](#)

[Agglomera Namespace](#)

ClusterSetEvaluation(TInstance).ClusterSet Property

Gets the cluster-set that was evaluated.

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
public ClusterSet<TInstance> ClusterSet { get; }
```

[View Source](#)

Property Value

Type: [ClusterSet](#)(TInstance)

See Also

[ClusterSetEvaluation\(TInstance\)Structure](#)

[Aglomera Namespace](#)

ClusterSetEvaluation(TInstance).EvaluationValue Property

Gets the value of the evaluation.

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

C#

```
public double EvaluationValue { get; }
```

[View Source](#)

Property Value

Type: [Double](#)

See Also

[ClusterSetEvaluation\(TInstance\)Structure](#)





[Aglomera Namespace](#)

ClusterSetEvaluation(TInstance).ClusterSetEvaluation(TInstance)

Methods

The [ClusterSetEvaluation\(TInstance\)](#) generic type exposes the following members.

Methods

	Name	Description
	Equals	(Inherited from ValueType .)
	GetHashCode	(Inherited from ValueType .)
	GetType	(Inherited from Object .)
	ToString	(Overrides ValueType.ToString() .)

See Also

[ClusterSetEvaluation\(TInstance\)Structure](#)

[Agglomera Namespace](#)

ClusterSetEvaluation(TInstance).ToString Method

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

C#

```
public override string ToString()
```

[View Source](#)

Return Value

Type: [String](#)

See Also

[ClusterSetEvaluation\(TInstance\)Structure](#)

[Aglomera Namespace](#)

Combinatorics Class

A utility class containing combinatorics methods.

Inheritance Hierarchy

[System.Object](#)

Aglomera.Combinatorics

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax







C#

```
public static class Combinatorics
```

[View Source](#)

The **Combinatorics** type exposes the following members.

Methods

	Name	Description
 	GetCombinations	Gets the number of possible combinations (without repetition) according to the given number of elements and combination size.
 	GetFactorial	Computes the factorial function $n!$ of a given integer number > 0 .
 	GetPermutations	Returns the number of possible permutations of k elements from a set of n (without repetition).







See Also

[Agglomera Namespace](#)

Combinatorics.Combinatorics Methods

The [Combinatorics](#) type exposes the following members.

Methods

	Name	Description
 	GetCombinations	Gets the number of possible combinations (without repetition) according to the given number of elements and combination size.
 	GetFactorial	Computes the factorial function $n!$ of a given integer number > 0 .
 	GetPermutations	Returns the number of possible permutations of k elements from a set of n (without repetition).

See Also

[Combinatorics Class](#)

[Agglomera Namespace](#)

Combinatorics.GetCombinations Method

Gets the number of possible combinations (without repetition) according to the given number of elements and combination size.

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public static long GetCombinations(  
    long n,  
    long k  
)
```

[View Source](#)

Parameters

n

Type: [System.Int64](#)

The number of elements in the set.

k

Type: [System.Int64](#)

The number of elements to choose from the set (combination size).

Return Value

Type: [Int64](#)

The number of possible combinations (without repetition).

Remarks

See http://www.mathwords.com/c/combination_formula.htm.

See Also

[Combinatorics Class](#)

[Agglomera Namespace](#)

Combinatorics.GetFactorial Method

Computes the factorial function $n!$ of a given integer number > 0 .

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public static long GetFactorial(  
    long n  
)
```

[View Source](#)

Parameters

n

Type: [System.Int64](#)

The number whose factorial we want to determine.

Return Value

Type: [Int64](#)

The factorial $n!$ of the given number.

See Also

[Combinatorics Class](#)

[Agglomera Namespace](#)

Combinatorics.GetPermutations Method

Returns the number of possible permutations of k elements from a set of n (without repetition).

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
public static long GetPermutations(  
    long n,  
    long k  
)
```

[View Source](#)

Parameters

n

Type: [System.Int64](#)

The number of elements in the set.

k

Type: [System.Int64](#)

The number of elements to choose from the set (permutation size).

Return Value

Type: [Int64](#)

Remarks

See http://www.mathwords.com/p/permutation_formula.htm.

See Also

[Combinatorics Class](#)

[Agglomera Namespace](#)

Extensions Class

Contains several extension utility methods.

Inheritance Hierarchy

[System.Object](#)

Aglomera.Extensions

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax




C#





```
public static class Extensions
```

[View Source](#)

The **Extensions** type exposes the following members.

Methods

Name	Description
 EvaluateClustering(TInstance)(ClusteringResult(TInstance), InternalEvaluationCriterion(TInstance))	Evaluates all given ClusterSet(TInstance) s according to the given InternalEvaluationCriterion(TInstance) . The maximum number of clusters allowed in a cluster-set for it to be evaluated corresponds to $\sqrt{N/2}$, where N is the total number of instances clustered.
 EvaluateClustering(TInstance)(ClusteringResult(TInstance), InternalEvaluationCriterion(TInstance), UInt32)	Evaluates all given ClusterSet(TInstance) s according to the given InternalEvaluationCriterion(TInstance) .
 EvaluateClustering(TInstance, TClass)(ClusteringResult(TInstance), IExternalEvaluationCriterion(TInstance, TClass), IDictionary(TInstance, TClass))	Evaluates all given ClusterSet(TInstance) s according to the given IExternalEvaluationCriterion(TInstance, TClass) . The maximum number of clusters allowed in a cluster-set for it to be evaluated corresponds to $\sqrt{N/2}$, where N is the total number of instances clustered.

 	EvaluateClustering(TInstance, TClass)(ClusteringResult(TInstance), IExternalEvaluationCriterion(TInstance, TClass), IDictionary(TInstance, TClass), UInt32)	Evaluates all given ClusterSet(TInstance) s according to the given IExternalEvaluationCriterion(TInstance, TClass) .
 	GetMedoid(TInstance)	Returns the medoid of a given Cluster(TInstance) , i.e., a representative object whose dissimilarity to all the instances in the cluster is minimal.






See Also

[Agglomera Namespace](#)

Extensions.Extensions Methods

The [Extensions](#) type exposes the following members.

Methods

Name	Description
 EvaluateClustering(TInstance)(ClusteringResult(TInstance), IInternalEvaluationCriterion(TInstance))	Evaluates all given ClusterSet(TInstance) s according to the given IInternalEvaluationCriterion(TInstance) . The maximum number of clusters allowed in a cluster-set for it to be evaluated corresponds to $\sqrt{N/2}$, where N is the total number of instances clustered.
 EvaluateClustering(TInstance)(ClusteringResult(TInstance), IInternalEvaluationCriterion(TInstance), UInt32)	Evaluates all given ClusterSet(TInstance) s according to the given IInternalEvaluationCriterion(TInstance) .
 EvaluateClustering(TInstance, TClass)(ClusteringResult(TInstance), IExternalEvaluationCriterion(TInstance, TClass), IDictionary(TInstance, TClass))	Evaluates all given ClusterSet(TInstance) s according to the given IExternalEvaluationCriterion(TInstance, TClass) . The maximum number of clusters allowed in a cluster-set for it to be evaluated corresponds to $\sqrt{N/2}$, where N is the total number of instances clustered.
 EvaluateClustering(TInstance, TClass)(ClusteringResult(TInstance), IExternalEvaluationCriterion(TInstance, TClass), IDictionary(TInstance, TClass), UInt32)	Evaluates all given ClusterSet(TInstance) s according to the given IExternalEvaluationCriterion(TInstance, TClass) .
 GetMedoid(TInstance)	Returns the medoid of a given Cluster(TInstance) , i.e., a representative object whose dissimilarity to all the instances in the cluster is minimal.








See Also

[Extensions Class](#)

[Agglomera Namespace](#)

Extensions.EvaluateClustering Method

Overload List

	Name	Description
 	EvaluateClustering(TInstance)(ClusteringResult(TInstance), IInternalEvaluationCriterion(TInstance))	Evaluates all given ClusterSet(TInstance) s according to the given IInternalEvaluationCriterion(TInstance) . The maximum number of clusters allowed in a cluster-set for it to be evaluated corresponds to $\sqrt{N/2}$, where N is the total number of instances clustered.
 	EvaluateClustering(TInstance, TClass)(ClusteringResult(TInstance), IExternalEvaluationCriterion(TInstance, TClass), IDictionary(TInstance, TClass))	Evaluates all given ClusterSet(TInstance) s according to the given IExternalEvaluationCriterion(TInstance, TClass) . The maximum number of clusters allowed in a cluster-set for it to be evaluated corresponds to $\sqrt{N/2}$, where N is the total number of instances clustered.
 	EvaluateClustering(TInstance)(ClusteringResult(TInstance), IInternalEvaluationCriterion(TInstance), UInt32)	Evaluates all given ClusterSet(TInstance) s according to the given IInternalEvaluationCriterion(TInstance) .
 	EvaluateClustering(TInstance, TClass)(ClusteringResult(TInstance), IExternalEvaluationCriterion(TInstance, TClass), IDictionary(TInstance, TClass), UInt32)	Evaluates all given ClusterSet(TInstance) s according to the given IExternalEvaluationCriterion(TInstance, TClass) .

See Also

[Extensions Class](#)

[Agglomera Namespace](#)

Extensions.EvaluateClustering(*TInstance*) Method (ClusteringResult(*TInstance*), InternalEvaluationCriterion(*TInstance*))

Evaluates all given [ClusterSet\(*TInstance*\)](#)s according to the given [InternalEvaluationCriterion\(*TInstance*\)](#). The maximum number of clusters allowed in a cluster-set for it to be evaluated corresponds to $\sqrt{N/2}$, where N is the total number of instances clustered.

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#
public static ICollection<ClusterSetEvaluation<TInstance>> EvaluateClustering<TInstance>(
    this ClusteringResult<TInstance> clustering,
    InternalEvaluationCriterion<TInstance> criterion
)
where TInstance : Object, IComparable<TInstance>
```

[View Source](#)

Parameters

clustering

Type: [Agglomera.ClusteringResult\(*TInstance*\)](#)

The cluster-sets to be evaluated.

criterion

Type: [Agglomera.Evaluation.Internal.InternalEvaluationCriterion\(*TInstance*\)](#)

The criterion used to evaluate the cluster-sets.

Type Parameters

TInstance

The type of instance considered.

Return Value

Type: [ICollection\(ClusterSetEvaluation\(*TInstance*\)\)](#)

A list containing the evaluations for each cluster-set.

Usage Note

In Visual Basic and C#, you can call this method as an instance method on any object of type [ClusteringResult\(*TInstance*\)](#). When you use instance method syntax to call this method, omit the first parameter. For more information, see [Extension Methods \(Visual Basic\)](#) or [Extension Methods \(C# Programming Guide\)](#).

See Also

[Extensions Class](#)

[EvaluateClustering Overload](#)

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[Aglomera Namespace](#)

Extensions.EvaluateClustering(TInstance, TClass) Method (ClusteringResult(TInstance), IExternalEvaluationCriterion(TInstance, TClass), IDictionary(TInstance, TClass))

Evaluates all given [ClusterSet\(TInstance\)](#)s according to the given [IExternalEvaluationCriterion\(TInstance, TClass\)](#). The maximum number of clusters allowed in a cluster-set for it to be evaluated corresponds to $\sqrt{N/2}$, where N is the total number of instances clustered.

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#
public static ICollection<ClusterSetEvaluation<TInstance>> EvaluateClustering<TInstance, TClass>(
    this ClusteringResult<TInstance> clustering,
    IExternalEvaluationCriterion<TInstance, TClass> criterion,
    IDictionary<TInstance, TClass> instanceClasses
)
where TInstance : Object, IComparable<TInstance>
```

[View Source](#)

Parameters

clustering

Type: [Agglomera.ClusteringResult\(TInstance\)](#)

The cluster-sets to be evaluated.

criterion

Type: [Agglomera.Evaluation.External.IExternalEvaluationCriterion\(TInstance, TClass\)](#)

The criterion used to evaluate the cluster-sets.

instanceClasses

Type: [System.Collections.Generic.IDictionary\(TInstance, TClass\)](#)

The instances' classes.

Type Parameters

TInstance

The type of instance considered.

TClass

The type of class considered.

Return Value

Type: [ICollection\(ClusterSetEvaluation\(TInstance\)\)](#)

A list containing the evaluations for each cluster-set.

Usage Note

In Visual Basic and C#, you can call this method as an instance method on any object of type [ClusteringResult](#)(***TInstance***). When you use instance method syntax to call this method, omit the first parameter. For more information, see [Extension Methods \(Visual Basic\)](#) or [Extension Methods \(C# Programming Guide\)](#).

See Also

[Extensions Class](#)

[EvaluateClustering Overload](#)

[Agglomera Namespace](#)

Extensions.EvaluateClustering(*TInstance*) Method (ClusteringResult(*TInstance*), InternalEvaluationCriterion(*TInstance*), UInt32)

Evaluates all given [ClusterSet\(*TInstance*\)](#)s according to the given [InternalEvaluationCriterion\(*TInstance*\)](#).

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#
public static ICollection<ClusterSetEvaluation<TInstance>> EvaluateClustering<TInstance>(
    this ClusteringResult<TInstance> clustering,
    InternalEvaluationCriterion<TInstance> criterion,
    uint maxClusters
)
where TInstance : Object, IComparable<TInstance>
```

[View Source](#)

Parameters

clustering

Type: [Agglomera.ClusteringResult\(*TInstance*\)](#)

The cluster-sets to be evaluated.

criterion

Type: [Agglomera.Evaluation.Internal.InternalEvaluationCriterion\(*TInstance*\)](#)

The criterion used to evaluate the cluster-sets.

maxClusters

Type: [System.UInt32](#)

The maximum number of clusters allowed for a cluster-set for it to be evaluated.

Type Parameters

TInstance

The type of instance considered.

Return Value

Type: [ICollection\(ClusterSetEvaluation\(*TInstance*\)\)](#)

A list containing the evaluations for each cluster-set.

Usage Note

In Visual Basic and C#, you can call this method as an instance method on any object of type [ClusteringResult\(*TInstance*\)](#). When you use instance method syntax to call this method, omit the first

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parameter. For more information, see [Extension Methods \(Visual Basic\)](#) or [Extension Methods \(C# Programming Guide\)](#).

See Also

[Extensions Class](#)

[EvaluateClustering Overload](#)

[Agglomera Namespace](#)

Extensions.EvaluateClustering(TInstance, TClass) Method (ClusteringResult(TInstance), IExternalEvaluationCriterion(TInstance, TClass), IDictionary(TInstance, TClass), UInt32)

Evaluates all given [ClusterSet\(TInstance\)](#)s according to the given [IExternalEvaluationCriterion\(TInstance, TClass\)](#).

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public static ICollection<ClusterSetEvaluation<TInstance>> EvaluateClustering<TInstance, TClass>(  
    this ClusteringResult<TInstance> clustering,  
    IExternalEvaluationCriterion<TInstance, TClass> criterion,  
    IDictionary<TInstance, TClass> instanceClasses,  
    uint maxClusters  
)  
where TInstance : Object, IComparable<TInstance>
```

[View Source](#)

Parameters

clustering

Type: [Agglomera.ClusteringResult\(TInstance\)](#)

The cluster-sets to be evaluated.

criterion

Type: [Agglomera.Evaluation.External.IExternalEvaluationCriterion\(TInstance, TClass\)](#)

The criterion used to evaluate the cluster-sets.

instanceClasses

Type: [System.Collections.Generic.IDictionary\(TInstance, TClass\)](#)

The instances' classes.

maxClusters

Type: [System.UInt32](#)

The maximum number of clusters allowed for a cluster-set for it to be evaluated.

Type Parameters

TInstance

The type of instance considered.

TClass

The type of class considered.

Return Value

Type: [ICollection](#)([ClusterSetEvaluation](#)(**TInstance**))

A list containing the evaluations for each cluster-set.

Usage Note

In Visual Basic and C#, you can call this method as an instance method on any object of type [ClusteringResult](#)(**TInstance**). When you use instance method syntax to call this method, omit the first parameter. For more information, see [Extension Methods \(Visual Basic\)](#) or [Extension Methods \(C# Programming Guide\)](#).

See Also

[Extensions Class](#)

[EvaluateClustering Overload](#)

[Agglomera Namespace](#)

Extensions.GetMedoid(TInstance) Method

Returns the medoid of a given [Cluster\(TInstance\)](#), i.e., a representative object whose dissimilarity to all the instances in the cluster is minimal.

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public static TInstance GetMedoid<TInstance>(  
    this Cluster<TInstance> cluster,  
    IDissimilarityMetric<TInstance> metric  
)  
where TInstance : Object, IComparable<TInstance>
```

[View Source](#)

Parameters

cluster

Type: [Agglomera.Cluster\(TInstance\)](#)

The cluster whose medoid we want to retrieve.

metric

Type: [Agglomera.IDissimilarityMetric\(TInstance\)](#)

The dissimilarity metric used to compare elements in the cluster, i.e., to calculate the distance between them.

Type Parameters

TInstance

The type of instance considered.

Return Value

Type: **TInstance**

The medoid of the given cluster. If the cluster has two elements, it returns the first element of the cluster.

Usage Note

In Visual Basic and C#, you can call this method as an instance method on any object of type [Cluster\(TInstance\)](#). When you use instance method syntax to call this method, omit the first parameter. For more information, see [Extension Methods \(Visual Basic\)](#) or [Extension Methods \(C# Programming Guide\)](#).

Remarks

"Medoids are representative objects of a data set or a cluster with a data set whose average dissimilarity to all the objects in the cluster is minimal. Medoids are similar in concept to means or

centroids, but medoids are always restricted to be members of the data set. Medoids are most commonly used on data when a mean or centroid cannot be defined, such as graphs. They are also used in contexts where the centroid is not representative of the dataset like in images and 3-D trajectories and gene expression (where while the data is sparse the medoid need not be). These are also of interest while wanting to find a representative using some distance other than squared euclidean distance (for instance in movie-ratings)." <https://en.wikipedia.org/wiki/Medoid>

See Also

[Extensions Class](#)

[Agglomera Namespace](#)

IClusteringAlgorithm(TInstance) Interface

Represents an interface for hierarchical agglomerative clustering algorithms.

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public interface IClusteringAlgorithm<TInstance>  
where TInstance : Object, IComparable<TInstance>
```

[View Source](#)


Type Parameters

TInstance




The type of instance considered.

The IClusteringAlgorithm(TInstance) type exposes the following members.

Properties

Name	Description
 LinkageCriterion	Gets the ILinkageCriterion(TInstance) used by this algorithm to create the clusters.

Methods

Name	Description
 GetClustering(ISet(TInstance))	Clusters the set of <i>TInstance</i> given to the algorithm.
 GetClustering(ClusterSet(TInstance))	Runs the clustering algorithm over the given ClusterSet(TInstance) .
 GetClustering(IEnumerable(Cluster(TInstance)), Double)	Runs the clustering algorithm over the set of given Cluster(TInstance) .

See Also

[Agglomera Namespace](#)

IClusteringAlgorithm(TInstance).IClusteringAlgorithm(TInstance) Properties

The [IClusteringAlgorithm\(TInstance\)](#) generic type exposes the following members.

Properties

	Name	Description
	LinkageCriterion	Gets the ILinkageCriterion(TInstance) used by this algorithm to create the clusters.

See Also

[IClusteringAlgorithm\(TInstance\)Interface](#)

[Agglomera Namespace](#)

IClusteringAlgorithm(TInstance).LinkageCriterion Property

Gets the [ILinkageCriterion\(TInstance\)](#) used by this algorithm to create the clusters.

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

C#

```
ILinkageCriterion<TInstance> LinkageCriterion { get; }
```

[View Source](#)

Property Value

Type: [ILinkageCriterion\(TInstance\)](#)

See Also




[IClusteringAlgorithm\(TInstance\)Interface](#)

[Agglomera Namespace](#)

IClusteringAlgorithm(TInstance).IClusteringAlgorithm(TInstance)

Methods

Methods

	Name	Description
	GetClustering(ISet(TInstance))	Clusters the set of <i>TInstance</i> given to the algorithm.
	GetClustering(ClusterSet(TInstance))	Runs the clustering algorithm over the given ClusterSet(TInstance) .
	GetClustering(IEnumerable(Cluster(TInstance)), Double)	Runs the clustering algorithm over the set of given Cluster(TInstance) .




See Also

[IClusteringAlgorithm\(TInstance\)Interface](#)

[Agglomera Namespace](#)

IClusteringAlgorithm(TInstance).GetClustering Method

Overload List

	Name	Description
	GetClustering(ISet(TInstance))	Clusters the set of <i>TInstance</i> given to the algorithm.
	GetClustering(ClusterSet(TInstance))	Runs the clustering algorithm over the given ClusterSet(TInstance) .
	GetClustering(IEnumerable(Cluster(TInstance)), Double)	Runs the clustering algorithm over the set of given Cluster(TInstance) .

See Also

[IClusteringAlgorithm\(TInstance\)Interface](#)

[Agglomera Namespace](#)

IClusteringAlgorithm(TInstance).GetClustering Method (ISet(TInstance))

Clusters the set of *TInstance* given to the algorithm.

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
ClusteringResult<TInstance> GetClustering(  
    ISet<TInstance> instances  
)
```

[View Source](#)

Parameters

instances

Type: [System.Collections.Generic.ISet\(TInstance\)](#)

The instances to be clustered by the algorithm.

Return Value

Type: [ClusteringResult\(TInstance\)](#)

A [ClusteringResult\(TInstance\)](#) containing all the [ClusterSet\(TInstance\)](#) found in each step of the algorithm and the corresponding the dissimilarity/distance at which they were found.

See Also

[IClusteringAlgorithm\(TInstance\)Interface](#)

[GetClustering Overload](#)

[Agglomera Namespace](#)

IClusteringAlgorithm(TInstance).GetClustering Method (ClusterSet(TInstance))

Runs the clustering algorithm over the given [ClusterSet\(TInstance\)](#).

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
ClusteringResult<TInstance> GetClustering(  
    ClusterSet<TInstance> clusterSet  
)
```

[View Source](#)

Parameters

clusterSet

Type: [Agglomera.ClusterSet\(TInstance\)](#)

The initial clusters and dissimilarity provided to the algorithm.

Return Value

Type: [ClusteringResult\(TInstance\)](#)

A [ClusteringResult\(TInstance\)](#) containing all the [ClusterSet\(TInstance\)](#) found in each step of the algorithm and the corresponding the dissimilarity/distance at which they were found.

See Also

[IClusteringAlgorithm\(TInstance\)Interface](#)

[GetClustering Overload](#)

[Aglomera Namespace](#)

IClusteringAlgorithm(TInstance).GetClustering Method (IEnumerable(Cluster(TInstance)), Double)

Runs the clustering algorithm over the set of given [Cluster\(TInstance\)](#).

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#
ClusteringResult<TInstance> GetClustering(
    IEnumerable<Cluster<TInstance>> clusters,
    double dissimilarity = 0
)
```

[View Source](#)

Parameters

clusters

Type: [System.Collections.Generic.IEnumerable\(Cluster\(TInstance\)\)](#)

The initial clusters provided to the algorithm.

dissimilarity (Optional)

Type: [System.Double](#)

The initial dissimilarity associated with the given clusters.

Return Value

Type: [ClusteringResult\(TInstance\)](#)

A [ClusteringResult\(TInstance\)](#) containing all the [ClusterSet\(TInstance\)](#) found in each step of the algorithm and the corresponding the dissimilarity/distance at which they were found.

See Also

[IClusteringAlgorithm\(TInstance\)Interface](#)

[GetClustering Overload](#)

[Agglomera Namespace](#)

IDissimilarityMetric(TInstance) Interface

Represents an interface for metrics measuring the dissimilarity/distance between instances.

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
public interface IDissimilarityMetric<in TInstance>
```

[View Source](#)


Type Parameters

TInstance

The type of instance considered.

The IDissimilarityMetric(TInstance) type exposes the following members.

Methods

	Name	Description
	Calculate	Calculates the distance between two instances according to this metric.

See Also


[Agglomera Namespace](#)

IDissimilarityMetric(TInstance).IDissimilarityMetric(TInstance)

Methods

The [IDissimilarityMetric\(TInstance\)](#) generic type exposes the following members.

Methods

	Name	Description
	Calculate	Calculates the distance between two instances according to this metric.

See Also

[IDissimilarityMetric\(TInstance\)Interface](#)

[Agglomera Namespace](#)

IDissimilarityMetric(TInstance).Calculate Method

Calculates the distance between two instances according to this metric.

Namespace: [Agglomera](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
double Calculate(  
    TInstance instance1,  
    TInstance instance2  
)
```

[View Source](#)

Parameters

instance1

Type: *TInstance*

The first instance.

instance2

Type: *TInstance*

The second instance.

Return Value

Type: [Double](#)

A value representing the distance between two instances according to this metric.


See Also

[IDissimilarityMetric\(TInstance\)Interface](#)

[Agglomera Namespace](#)

Aglomera.D3 Namespace

Classes

	Class	Description
	D3Extensions	Contains a set of extensions for ClusteringResult(TInstance) objects to enable export to D3.js dendrogram files.

D3Extensions Class

Contains a set of extensions for [ClusteringResult\(TInstance\)](#) objects to enable export to D3.js dendrogram files.

Inheritance Hierarchy

[System.Object](#)

Aglomera.D3.D3Extensions

Namespace: [Agglomera.D3](#)

Assembly: Aglomera.D3 (in Aglomera.D3.dll) Version: 1.1.0

Syntax



C#

```
public static class D3Extensions
```

[View Source](#)

The **D3Extensions** type exposes the following members.

Methods

	Name	Description
 	SaveD3DendrogramFile(TInstance)	Saves the given ClusteringResult(TInstance) to a d3.js dendrogram file.


See Also

[Agglomera.D3 Namespace](#)

D3Extensions.D3Extensions Methods

The [D3Extensions](#) type exposes the following members.

Methods

	Name	Description
	SaveD3DendrogramFile(TInstance)	Saves the given ClusteringResult(TInstance) to a d3.js dendrogram file.

See Also

[D3Extensions Class](#)

[Agglomera.D3 Namespace](#)

D3Extensions.SaveD3DendrogramFile(TInstance) Method

Saves the given [ClusteringResult\(TInstance\)](#) to a d3.js dendrogram file.

Namespace: [Agglomera.D3](#)

Assembly: Aglomera.D3 (in Aglomera.D3.dll) Version: 1.1.0

Syntax

```
C#  
  
public static void SaveD3DendrogramFile<TInstance>(  
    this ClusteringResult<TInstance> clustering,  
    string filePath,  
    bool printNames = true,  
    Formatting formatting = Formatting.None  
)  
where TInstance : Object, IComparable<TInstance>
```

[View Source](#)

Parameters

clustering

Type: [Aglomera.ClusteringResult\(TInstance\)](#)

The clustering result to be saved to a dendrogram file.

filePath

Type: [System.String](#)

The path to the file in which to save the clustering dendrogram.

printNames (Optional)

Type: [System.Boolean](#)

Whether to include clusters' string representation in their nodes.

formatting (Optional)

Type: **Formatting**

The Json file formatting.

Type Parameters

TInstance

The type of instance considered.

Usage Note

In Visual Basic and C#, you can call this method as an instance method on any object of type [ClusteringResult\(TInstance\)](#). When you use instance method syntax to call this method, omit the first parameter. For more information, see [Extension Methods \(Visual Basic\)](#) or [Extension Methods \(C# Programming Guide\)](#).

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See Also

[D3Extensions Class](#)


[Agglomera.D3 Namespace](#)

Aglomera.Evaluation.External Namespace

Classes

Class	Description
 CombinedExternalCriterion(TInstance, TClass)	Implements an external clustering evaluation criterion as a combination (weighted average) of other IExternalEvaluationCriterion(TInstance, TClass) .
 FMeasure(TInstance, TClass)	Evaluates the given partition according to the F-measure, i.e., it measures the accuracy of the clustering by measuring the percentage of decisions that are correct (true positives + true negatives).
 NormalizedMutualInformation(TInstance, TClass)	Evaluates the given partition according to the normalized mutual information criterion that measures the amount of information by which our knowledge about the classes increases when we are told what the clusters are.
 Precision(TInstance, TClass)	Evaluates the given partition according to the precision criterion, given by the percentage of true positives over all positives.
 Purity(TInstance, TClass)	Evaluates the given partition according to the purity criterion, where each cluster is assigned to its most frequent class, and then the accuracy of this assignment is measured by counting the number of correctly assigned instances and dividing by the total number of instances.
 RandIndex(TInstance, TClass)	Evaluates the given partition according to the Rand index, i.e., it measures the accuracy of the clustering by measuring the percentage of decisions that are correct (true positives + true negatives).
 Recall(TInstance, TClass)	Evaluates the given partition according to the recall criterion, given by the percentage of true positives over all relevant cases (true positives + false negatives).

Interfaces

Interface	Description
 IExternalEvaluationCriterion(TInstance, TClass)	Represents an interface for external criteria to evaluate how well the result of AgglomerativeClusteringAlgorithm(TInstance) matches the classification of instances according to a set of gold standard classes. We can think of this as supervised

		clustering evaluation methods, i.e., external validation methods.
--	--	---

CombinedExternalCriterion(TInstance, TClass) Class

Implements an external clustering evaluation criterion as a combination (weighted average) of other [IExternalEvaluationCriterion\(TInstance, TClass\)](#).

Inheritance Hierarchy

[System.Object](#)

Aglomera.Evaluation.External.CombinedExternalCriterion(TInstance, TClass)

Namespace: [Agglomera.Evaluation.External](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

C#

```
public class CombinedExternalCriterion<TInstance, TClass> : IExternalEvaluationCriterion<TInstance, TClass>
where TInstance : Object, IComparable<TInstance>
```

[View Source](#)

Type Parameters

TInstance


The type of instance considered.

TClass






The type of class considered.

The CombinedExternalCriterion(TInstance, TClass) type exposes the following members.

Constructors

Name	Description
 CombinedExternalCriterion(TInstance, TClass)	Creates a new CombinedExternalCriterion(TInstance, TClass) according to the given criteria and respective weights.

Methods

Name	Description
 Equals	(Inherited from Object .)
 Evaluate	Evaluates a given ClusterSet(TInstance) partition according to the given class partition.
 Finalize	(Inherited from Object .)
 GetHashCode	(Inherited from Object .)
 GetType	(Inherited from Object .)

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	MemberwiseClone	(Inherited from Object.)
	ToString	(Inherited from Object.)

See Also

[Agglomera.Evaluation.External Namespace](#)

CombinedExternalCriterion(TInstance, TClass) Constructor

Creates a new [CombinedExternalCriterion\(TInstance, TClass\)](#) according to the given criteria and respective weights.

Namespace: [Agglomera.Evaluation.External](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
public CombinedExternalCriterion(  
    IDictionary<IExternalEvaluationCriterion<TInstance, TClass>, double> criteria  
)
```

[View Source](#)

Parameters

criteria

Type: [System.Collections.Generic.IDictionary\(IExternalEvaluationCriterion\(TInstance, TClass\), Double\)](#)

A dictionary containing the several criteria to be used and how should they be combined, i.e., their associated weights.

See Also








[CombinedExternalCriterion\(TInstance, TClass\)Class](#)

[Agglomera.Evaluation.External Namespace](#)

CombinedExternalCriterion(TInstance, TClass).CombinedExternalCriterion(TInstance, TClass) Methods

The [CombinedExternalCriterion\(TInstance, TClass\)](#) generic type exposes the following members.

Methods

	Name	Description
	Equals	(Inherited from Object .)
	Evaluate	Evaluates a given ClusterSet(TInstance) partition according to the given class partition.
	Finalize	(Inherited from Object .)
	GetHashCode	(Inherited from Object .)
	GetType	(Inherited from Object .)
	MemberwiseClone	(Inherited from Object .)
	ToString	(Inherited from Object .)

See Also

[CombinedExternalCriterion\(TInstance, TClass\)Class](#)

[Agglomera.Evaluation.External Namespace](#)

CombinedExternalCriterion(TInstance, TClass).Evaluate Method

Evaluates a given [ClusterSet\(TInstance\)](#) partition according to the given class partition.

Namespace: [Agglomera.Evaluation.External](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public double Evaluate(  
    ClusterSet<TInstance> clusterSet,  
    IDictionary<TInstance, TClass> instanceClasses  
)
```

[View Source](#)

Parameters

clusterSet

Type: [Agglomera.ClusterSet](#)(TInstance)

The clustering partition.

instanceClasses

Type: [System.Collections.Generic.IDictionary](#)(TInstance, TClass)

The instances' classes.

Return Value

Type: [Double](#)

The evaluation of the given clustering according to this criterion.

Implements

[IExternalEvaluationCriterion](#)(TInstance, TClass).Evaluate(ClusterSet(TInstance),
IDictionary(TInstance, TClass))

See Also

[CombinedExternalCriterion\(TInstance, TClass\) Class](#)

[Agglomera.Evaluation.External Namespace](#)

FMeasure(TInstance, TClass) Class

Evaluates the given partition according to the F-measure, i.e., it measures the accuracy of the clustering by measuring the percentage of decisions that are correct (true positives + true negatives).

Inheritance Hierarchy

[System.Object](#)

Aglomera.Evaluation.External.FMeasure(TInstance, TClass)

Namespace: [Agglomera.Evaluation.External](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public class FMeasure<TInstance, TClass> : IExternalEvaluationCriterion<TInstance, TClass>  
where TInstance : Object, IComparable<TInstance>
```

[View Source](#)

Type Parameters

TInstance


The type of instance considered.

TClass


The type of class considered.

The FMeasure(TInstance, TClass) type exposes the following members.

Constructors







	Name	Description
	FMeasure(TInstance, TClass)	Creates a new instance of FMeasure(TInstance, TClass) with the given recall weight.

Properties

	Name	Description
	RecallWeight	Gets the weight given to recall in comparison to precision.

Methods

	Name	Description
	Equals	(Inherited from Object .)

	Evaluate	Evaluates a given ClusterSet(TInstance) partition according to the given class partition.
	Finalize	(Inherited from Object.)
	GetHashCode	(Inherited from Object.)
	GetType	(Inherited from Object.)
	MemberwiseClone	(Inherited from Object.)
	ToString	(Inherited from Object.)

Remarks

see: <https://nlp.stanford.edu/IR-book/html/htmledition/evaluation-of-clustering-1.html>

See Also

[Agglomera.Evaluation.External Namespace](#)

FMeasure(TInstance, TClass) Constructor

Creates a new instance of [FMeasure\(TInstance, TClass\)](#) with the given recall weight.

Namespace: [Agglomera.Evaluation.External](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public FMeasure(  
    double recallWeight  
)
```

[View Source](#)

Parameters

recallWeight

Type: [System.Double](#)

The weight given to recall in comparison to precision.

See Also


[FMeasure\(TInstance, TClass\)Class](#)

[Agglomera.Evaluation.External Namespace](#)

FMeasure(TInstance, TClass).FMeasure(TInstance, TClass) Properties

The [FMeasure\(TInstance, TClass\)](#) generic type exposes the following members.

Properties

	Name	Description
	RecallWeight	Gets the weight given to recall in comparison to precision.

See Also

[FMeasure\(TInstance, TClass\)Class](#)

[Agglomera.Evaluation.External Namespace](#)

FMeasure(TInstance, TClass).RecallWeight Property

Gets the weight given to recall in comparison to precision.

Namespace: [Aglomera.Evaluation.External](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

C#

```
public double RecallWeight { get; }
```

[View Source](#)

Property Value

Type: [Double](#)

See Also








[FMeasure\(TInstance, TClass\)Class](#)

[Aglomera.Evaluation.External Namespace](#)

FMeasure(TInstance, TClass).FMeasure(TInstance, TClass) Methods

The [FMeasure\(TInstance, TClass\)](#) generic type exposes the following members.

Methods

	Name	Description
	Equals	(Inherited from Object .)
	Evaluate	Evaluates a given ClusterSet(TInstance) partition according to the given class partition.
	Finalize	(Inherited from Object .)
	GetHashCode	(Inherited from Object .)
	GetType	(Inherited from Object .)
	MemberwiseClone	(Inherited from Object .)
	ToString	(Inherited from Object .)

See Also

[FMeasure\(TInstance, TClass\)Class](#)

[Agglomera.Evaluation.External Namespace](#)

FMeasure(TInstance, TClass).Evaluate Method

Evaluates a given [ClusterSet\(TInstance\)](#) partition according to the given class partition.

Namespace: [Agglomera.Evaluation.External](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public double Evaluate(  
    ClusterSet<TInstance> clusterSet,  
    IDictionary<TInstance, TClass> instanceClasses  
)
```

[View Source](#)

Parameters

clusterSet

Type: [Agglomera.ClusterSet](#)(TInstance)

The clustering partition.

instanceClasses

Type: [System.Collections.Generic.IDictionary](#)(TInstance, TClass)

The instances' classes.

Return Value

Type: [Double](#)

The evaluation of the given clustering according to this criterion.

Implements

[IExternalEvaluationCriterion](#)(TInstance, TClass).Evaluate(ClusterSet(TInstance),
IDictionary(TInstance, TClass))

See Also

[FMeasure\(TInstance, TClass\)Class](#)

[Agglomera.Evaluation.External Namespace](#)

IExternalEvaluationCriterion(TInstance, TClass) Interface

Represents an interface for external criteria to evaluate how well the result of [AgglomerativeClusteringAlgorithm\(TInstance\)](#) matches the classification of instances according to a set of gold standard classes. We can think of this as supervised clustering evaluation methods, i.e., external validation methods.

Namespace: [Aglomera.Evaluation.External](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public interface IExternalEvaluationCriterion<TInstance, TClass>  
where TInstance : Object, IComparable<TInstance>
```

[View Source](#)

Type Parameters

TInstance


The type of instance considered.

TClass

The type of class considered.

The IExternalEvaluationCriterion(TInstance, TClass) type exposes the following members.

Methods

	Name	Description
	Evaluate	Evaluates a given ClusterSet(TInstance) partition according to the given class partition.

Remarks

These methods are useful for when we have some known partition over the instances and want to evaluate the quality of the clustering according to that partition. It can also be used to select the most appropriate [ILinkageCriterion\(TInstance\)](#) for a given annotated data-set.


See Also

[Aglomera.Evaluation.External Namespace](#)

[IExternalEvaluationCriterion\(TInstance, TClass\).IExternalEvaluationCriterion\(TInstance, TClass\) Methods](#)

The [IExternalEvaluationCriterion\(TInstance, TClass\)](#) generic type exposes the following members.

Methods

	Name	Description
	Evaluate	Evaluates a given ClusterSet(TInstance) partition according to the given class partition.

See Also

[IExternalEvaluationCriterion\(TInstance, TClass\)Interface](#)

[Agglomera.Evaluation.External Namespace](#)

[IExternalEvaluationCriterion\(TInstance, TClass\).Evaluate Method](#)

Evaluates a given [ClusterSet\(TInstance\)](#) partition according to the given class partition.

Namespace: [Agglomera.Evaluation.External](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
double Evaluate(  
    ClusterSet<TInstance> clusterSet,  
    IDictionary<TInstance, TClass> instanceClasses  
)
```

[View Source](#)

Parameters

clusterSet

Type: [Agglomera.ClusterSet](#)(*TInstance*)

The clustering partition.

instanceClasses

Type: [System.Collections.Generic.IDictionary](#)(*TInstance*, *TClass*)

The instances' classes.

Return Value

Type: [Double](#)

The evaluation of the given clustering according to this criterion.

See Also

[IExternalEvaluationCriterion\(TInstance, TClass\)Interface](#)

[Agglomera.Evaluation.External Namespace](#)

NormalizedMutualInformation(TInstance, TClass) Class

Evaluates the given partition according to the normalized mutual information criterion that measures the amount of information by which our knowledge about the classes increases when we are told what the clusters are.

Inheritance Hierarchy

[System.Object](#)

Aglomera.Evaluation.External.NormalizedMutualInformation(TInstance, TClass)

Namespace: [Agglomera.Evaluation.External](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public class NormalizedMutualInformation<TInstance, TClass> : IExternalEvaluationCriterion<TInstance,  
TClass>  
where TInstance : Object, IComparable<TInstance>
```

[View Source](#)

Type Parameters

TInstance


The type of instance considered.

TClass




The type of class considered.





The NormalizedMutualInformation(TInstance, TClass) type exposes the following members.

Constructors

	Name	Description
	NormalizedMutualInformation(TInstance, TClass)	Initializes a new instance of the NormalizedMutualInformation(TInstance, TClass) class

Methods

	Name	Description
	Equals	(Inherited from Object .)
	Evaluate	Evaluates a given ClusterSet(TInstance) partition according to the given class partition.
	Finalize	(Inherited from Object .)

	GetHashCode	(Inherited from Object.)
	GetType	(Inherited from Object.)
	MemberwiseClone	(Inherited from Object.)
	ToString	(Inherited from Object.)

Remarks

see: <https://nlp.stanford.edu/IR-book/html/htmledition/evaluation-of-clustering-1.html>

See Also

[Agglomera.Evaluation.External Namespace](#)

NormalizedMutualInformation(TInstance, TClass) Constructor

Initializes a new instance of the [NormalizedMutualInformation\(TInstance, TClass\)](#) class

Namespace: [Agglomera.Evaluation.External](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

C#

```
public NormalizedMutualInformation()
```

[View Source](#)

See Also








[NormalizedMutualInformation\(TInstance, TClass\)Class](#)

[Agglomera.Evaluation.External Namespace](#)

NormalizedMutualInformation(TInstance, TClass).NormalizedMutualInformation(TInstance, TClass) Methods

The [NormalizedMutualInformation\(TInstance, TClass\)](#) generic type exposes the following members.

Methods

	Name	Description
	Equals	(Inherited from Object .)
	Evaluate	Evaluates a given ClusterSet(TInstance) partition according to the given class partition.
	Finalize	(Inherited from Object .)
	GetHashCode	(Inherited from Object .)
	GetType	(Inherited from Object .)
	MemberwiseClone	(Inherited from Object .)
	ToString	(Inherited from Object .)

See Also

[NormalizedMutualInformation\(TInstance, TClass\)Class](#)

[Agglomera.Evaluation.External Namespace](#)

NormalizedMutualInformation(TInstance, TClass).Evaluate Method

Evaluates a given [ClusterSet\(TInstance\)](#) partition according to the given class partition.

Namespace: [Agglomera.Evaluation.External](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public double Evaluate(  
    ClusterSet<TInstance> clusterSet,  
    IDictionary<TInstance, TClass> instanceClasses  
)
```

[View Source](#)

Parameters

clusterSet

Type: [Agglomera.ClusterSet](#)(TInstance)

The clustering partition.

instanceClasses

Type: [System.Collections.Generic.IDictionary](#)(TInstance, TClass)

The instances' classes.

Return Value

Type: [Double](#)

The evaluation of the given clustering according to this criterion.

Implements

[IExternalEvaluationCriterion](#)(TInstance, TClass).Evaluate(ClusterSet(TInstance),
IDictionary(TInstance, TClass))

See Also

[NormalizedMutualInformation\(TInstance, TClass\)Class](#)

[Agglomera.Evaluation.External](#) Namespace

Precision(TInstance, TClass) Class

Evaluates the given partition according to the precision criterion, given by the percentage of true positives over all positives.

Inheritance Hierarchy

[System.Object](#)

Aglomera.Evaluation.External.Precision(TInstance, TClass)

Namespace: [Agglomera.Evaluation.External](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

C#

```
public class Precision<TInstance, TClass> : IExternalEvaluationCriterion<TInstance, TClass>
where TInstance : Object, IComparable<TInstance>
```

[View Source](#)

Type Parameters

TInstance


The type of instance considered.

TClass







The type of class considered.

The Precision(TInstance, TClass) type exposes the following members.

Constructors

Name	Description
 Precision(TInstance, TClass)	Initializes a new instance of the Precision(TInstance, TClass) class

Methods

Name	Description
 Equals	(Inherited from Object .)
 Evaluate	Evaluates a given ClusterSet(TInstance) partition according to the given class partition.
 Finalize	(Inherited from Object .)
 GetHashCode	(Inherited from Object .)
 GetType	(Inherited from Object .)
 MemberwiseClone	(Inherited from Object .)

 ToString	(Inherited from Object .)
--	---

Remarks

see: <https://nlp.stanford.edu/IR-book/html/htmledition/evaluation-of-clustering-1.html>

See Also

[Agglomera.Evaluation.External Namespace](#)

Precision(TInstance, TClass) Constructor

Initializes a new instance of the [Precision\(TInstance, TClass\)](#) class

Namespace: [Agglomera.Evaluation.External](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

C#

```
public Precision()
```

[View Source](#)

See Also








[Precision\(TInstance, TClass\)Class](#)

[Agglomera.Evaluation.External Namespace](#)

Precision(TInstance, TClass).Precision(TInstance, TClass) Methods

The [Precision\(TInstance, TClass\)](#) generic type exposes the following members.

Methods

	Name	Description
	Equals	(Inherited from Object .)
	Evaluate	Evaluates a given ClusterSet(TInstance) partition according to the given class partition.
	Finalize	(Inherited from Object .)
	GetHashCode	(Inherited from Object .)
	GetType	(Inherited from Object .)
	MemberwiseClone	(Inherited from Object .)
	ToString	(Inherited from Object .)

See Also

[Precision\(TInstance, TClass\)Class](#)

[Agglomera.Evaluation.External Namespace](#)

Precision(TInstance, TClass).Evaluate Method

Evaluates a given [ClusterSet\(TInstance\)](#) partition according to the given class partition.

Namespace: [Agglomera.Evaluation.External](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public double Evaluate(  
    ClusterSet<TInstance> clusterSet,  
    IDictionary<TInstance, TClass> instanceClasses  
)
```

[View Source](#)

Parameters

clusterSet

Type: [Agglomera.ClusterSet](#)(TInstance)

The clustering partition.

instanceClasses

Type: [System.Collections.Generic.IDictionary](#)(TInstance, TClass)

The instances' classes.

Return Value

Type: [Double](#)

The evaluation of the given clustering according to this criterion.

Implements

[IExternalEvaluationCriterion](#)(TInstance, TClass).Evaluate(ClusterSet(TInstance),
IDictionary(TInstance, TClass))

See Also

[Precision\(TInstance, TClass\)Class](#)

[Agglomera.Evaluation.External Namespace](#)

Purity(TInstance, TClass) Class

Evaluates the given partition according to the purity criterion, where each cluster is assigned to its most frequent class, and then the accuracy of this assignment is measured by counting the number of correctly assigned instances and dividing by the total number of instances.

Inheritance Hierarchy

[System.Object](#)

Aglomera.Evaluation.External.Purity(TInstance, TClass)

Namespace: [Agglomera.Evaluation.External](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public class Purity<TInstance, TClass> : IExternalEvaluationCriterion<TInstance, TClass>  
where TInstance : Object, IComparable<TInstance>
```

[View Source](#)

Type Parameters

TInstance


The type of instance considered.

TClass






The type of class considered.



The Purity(TInstance, TClass) type exposes the following members.

Constructors

	Name	Description
	Purity(TInstance, TClass)	Initializes a new instance of the Purity(TInstance, TClass) class

Methods

	Name	Description
	Equals	(Inherited from Object .)
	Evaluate	Evaluates a given ClusterSet(TInstance) partition according to the given class partition.
	Finalize	(Inherited from Object .)
	GetHashCode	(Inherited from Object .)
	GetType	(Inherited from Object .)

	MemberwiseClone	(Inherited from Object.)
	ToString	(Inherited from Object.)

Remarks

see: <https://nlp.stanford.edu/IR-book/html/htmledition/evaluation-of-clustering-1.html>

See Also

[Agglomera.Evaluation.External Namespace](#)

Purity(TInstance, TClass) Constructor

Initializes a new instance of the [Purity\(TInstance, TClass\)](#) class

Namespace: [Agglomera.Evaluation.External](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

C#

```
public Purity()
```

[View Source](#)

See Also








[Purity\(TInstance, TClass\)Class](#)

[Agglomera.Evaluation.External Namespace](#)

Purity(TInstance, TClass).Purity(TInstance, TClass) Methods

The [Purity\(TInstance, TClass\)](#) generic type exposes the following members.

Methods

	Name	Description
	Equals	(Inherited from Object .)
	Evaluate	Evaluates a given ClusterSet(TInstance) partition according to the given class partition.
	Finalize	(Inherited from Object .)
	GetHashCode	(Inherited from Object .)
	GetType	(Inherited from Object .)
	MemberwiseClone	(Inherited from Object .)
	ToString	(Inherited from Object .)

See Also

[Purity\(TInstance, TClass\)Class](#)

[Agglomera.Evaluation.External Namespace](#)

Purity(TInstance, TClass).Evaluate Method

Evaluates a given [ClusterSet\(TInstance\)](#) partition according to the given class partition.

Namespace: [Agglomera.Evaluation.External](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public double Evaluate(  
    ClusterSet<TInstance> clusterSet,  
    IDictionary<TInstance, TClass> instanceClasses  
)
```

[View Source](#)

Parameters

clusterSet

Type: [Aglomera.ClusterSet](#)(TInstance)

The clustering partition.

instanceClasses

Type: [System.Collections.Generic.IDictionary](#)(TInstance, TClass)

The instances' classes.

Return Value

Type: [Double](#)

The evaluation of the given clustering according to this criterion.

Implements

[IExternalEvaluationCriterion](#)(TInstance, TClass).Evaluate(ClusterSet(TInstance),
IDictionary(TInstance, TClass))

See Also

[Purity\(TInstance, TClass\)Class](#)

[Aglomera.Evaluation.External Namespace](#)

RandIndex(TInstance, TClass) Class

Evaluates the given partition according to the Rand index, i.e., it measures the accuracy of the clustering by measuring the percentage of decisions that are correct (true positives + true negatives).

Inheritance Hierarchy

[System.Object](#)

Aglomera.Evaluation.External.RandIndex(TInstance, TClass)

Namespace: [Agglomera.Evaluation.External](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

C#

```
public class RandIndex<TInstance, TClass> : IExternalEvaluationCriterion<TInstance, TClass>
where TInstance : Object, IComparable<TInstance>
```

[View Source](#)

Type Parameters

TInstance


The type of instance considered.

TClass






The type of class considered.



The RandIndex(TInstance, TClass) type exposes the following members.

Constructors

	Name	Description
	RandIndex(TInstance, TClass)	Initializes a new instance of the RandIndex(TInstance, TClass) class

Methods

	Name	Description
	Equals	(Inherited from Object .)
	Evaluate	Evaluates a given ClusterSet(TInstance) partition according to the given class partition.
	Finalize	(Inherited from Object .)
	GetHashCode	(Inherited from Object .)
	GetType	(Inherited from Object .)

	MemberwiseClone	(Inherited from Object .)
	ToString	(Inherited from Object .)

Remarks

see: <https://nlp.stanford.edu/IR-book/html/htmledition/evaluation-of-clustering-1.html>

See Also

[Agglomera.Evaluation.External Namespace](#)

RandIndex(TInstance, TClass) Constructor

Initializes a new instance of the [RandIndex\(TInstance, TClass\)](#) class

Namespace: [Agglomera.Evaluation.External](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

C#

```
public RandIndex()
```

[View Source](#)

See Also








[RandIndex\(TInstance, TClass\)Class](#)

[Agglomera.Evaluation.External Namespace](#)

RandIndex(TInstance, TClass).RandIndex(TInstance, TClass) Methods

The [RandIndex\(TInstance, TClass\)](#) generic type exposes the following members.

Methods

	Name	Description
	Equals	(Inherited from Object .)
	Evaluate	Evaluates a given ClusterSet(TInstance) partition according to the given class partition.
	Finalize	(Inherited from Object .)
	GetHashCode	(Inherited from Object .)
	GetType	(Inherited from Object .)
	MemberwiseClone	(Inherited from Object .)
	ToString	(Inherited from Object .)

See Also

[RandIndex\(TInstance, TClass\)Class](#)

[Agglomera.Evaluation.External Namespace](#)

RandIndex(TInstance, TClass).Evaluate Method

Evaluates a given [ClusterSet\(TInstance\)](#) partition according to the given class partition.

Namespace: [Agglomera.Evaluation.External](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public double Evaluate(  
    ClusterSet<TInstance> clusterSet,  
    IDictionary<TInstance, TClass> instanceClasses  
)
```

[View Source](#)

Parameters

clusterSet

Type: [Agglomera.ClusterSet](#)(TInstance)

The clustering partition.

instanceClasses

Type: [System.Collections.Generic.IDictionary](#)(TInstance, TClass)

The instances' classes.

Return Value

Type: [Double](#)

The evaluation of the given clustering according to this criterion.

Implements

[IExternalEvaluationCriterion](#)(TInstance, TClass).Evaluate(ClusterSet(TInstance),
IDictionary(TInstance, TClass))

See Also

[RandIndex\(TInstance, TClass\)Class](#)

[Agglomera.Evaluation.External](#) Namespace

Recall(TInstance, TClass) Class

Evaluates the given partition according to the recall criterion, given by the percentage of true positives over all relevant cases (true positives + false negatives).

Inheritance Hierarchy

[System.Object](#)

Aglomera.Evaluation.External.Recall(TInstance, TClass)

Namespace: [Agglomera.Evaluation.External](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
public class Recall<TInstance, TClass> : IExternalEvaluationCriterion<TInstance, TClass>  
where TInstance : Object, IComparable<TInstance>
```

[View Source](#)

Type Parameters

TInstance


The type of instance considered.

TClass







The type of class considered.

The Recall(TInstance, TClass) type exposes the following members.

Constructors

Name	Description
 Recall(TInstance, TClass)	Initializes a new instance of the Recall(TInstance, TClass) class

Methods

Name	Description
 Equals	(Inherited from Object .)
 Evaluate	Evaluates a given ClusterSet(TInstance) partition according to the given class partition.
 Finalize	(Inherited from Object .)
 GetHashCode	(Inherited from Object .)
 GetType	(Inherited from Object .)
 MemberwiseClone	(Inherited from Object .)

 ToString	(Inherited from Object .)
--	---

Remarks

see: <https://nlp.stanford.edu/IR-book/html/htmledition/evaluation-of-clustering-1.html>

See Also

[Aglomera.Evaluation.External Namespace](#)

Recall(*TInstance*, *TClass*) Constructor

Initializes a new instance of the [Recall\(*TInstance*, *TClass*\)](#) class

Namespace: [Agglomera.Evaluation.External](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

C#

```
public Recall()
```

[View Source](#)

See Also








[Recall\(*TInstance*, *TClass*\)Class](#)

[Agglomera.Evaluation.External Namespace](#)

Recall(*TInstance*, *TClass*).Recall(*TInstance*, *TClass*) Methods

The [Recall\(*TInstance*, *TClass*\)](#) generic type exposes the following members.

Methods

	Name	Description
	Equals	(Inherited from Object .)
	Evaluate	Evaluates a given ClusterSet(<i>TInstance</i>) partition according to the given class partition.
	Finalize	(Inherited from Object .)
	GetHashCode	(Inherited from Object .)
	GetType	(Inherited from Object .)
	MemberwiseClone	(Inherited from Object .)
	ToString	(Inherited from Object .)

See Also

[Recall\(*TInstance*, *TClass*\)Class](#)

[Agglomera.Evaluation.External Namespace](#)

Recall(*TInstance*, *TClass*).Evaluate Method

Evaluates a given [ClusterSet\(*TInstance*\)](#) partition according to the given class partition.

Namespace: [Agglomera.Evaluation.External](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public double Evaluate(  
    ClusterSet<TInstance> clusterSet,  
    IDictionary<TInstance, TClass> instanceClasses  
)
```

[View Source](#)

Parameters

clusterSet

Type: [Agglomera.ClusterSet](#)(*TInstance*)

The clustering partition.

instanceClasses

Type: [System.Collections.Generic.IDictionary](#)(*TInstance*, *TClass*)

The instances' classes.

Return Value

Type: [Double](#)

The evaluation of the given clustering according to this criterion.

Implements

[IExternalEvaluationCriterion](#)(*TInstance*, *TClass*).Evaluate([ClusterSet](#)(*TInstance*),
[IDictionary](#)(*TInstance*, *TClass*))







See Also






[Recall\(*TInstance*, *TClass*\)Class](#)

[Agglomera.Evaluation.External](#) Namespace


Aglomera.Evaluation.Internal Namespace

Classes

Class	Description
 CalinskiHarabaszIndex(TInstance)	Implements the internal evaluation method in [1] that measures compactness and separation of clusters simultaneously. The numerator reflects the degree of separation in the way of how much the cluster centers are spread, and the denominator corresponds to compactness, to reflect how close the within-cluster objects are gathered around the cluster center.
 CombinedInternalCriterion(TInstance)	Implements an internal clustering evaluation criterion as a combination (weighted average) of other InternalEvaluationCriterion(TInstance) .
 DaviesBouldinIndex(TInstance)	Implements the internal evaluation method in [1] that measures the "ratio of the within cluster scatter to the between cluster separation" [2].
 DunnIndex(TInstance)	Implements the internal evaluation method in [1] that measures the ratio between the smallest distance between observations not in the same cluster to the largest intra-cluster distance. The Dunn Index has a value between zero and infinity, and a higher index indicates a better clustering. The aim is to identify sets of clusters that are compact, with a small variance between members of the cluster, and well separated, where the means of different clusters are sufficiently far apart, as compared to the within cluster variance [2].
 IIndex(TInstance)	Implements the I-index internal evaluation method [1] that uses the ratio of the separation and compactness of a given clustering partition scheme. To measure separation, it adopts the maximum distance between cluster centers and for compactness, the distance from an to its cluster center.
 ModifiedGammaStatistic(TInstance)	Implements an internal evaluation method based on a modified/improved version of Hubert's Gamma (Γ) statistic in [1] with the transformation introduced in [2] in order to be maximized.
 RootMeanSquareStdDev(TInstance)	Implements an internal evaluation method measuring the root-mean-square standard deviation (RMSSD), i.e., the square root of the variance between all elements. This criterion considers only the compactness of the clustering partition.

	RSquared(TInstance)	Implements an internal evaluation method measuring the complement of the ratio of the sum of squared distances between elements in different clusters to the total sum of squares. This criterion considers only the separation between the clusters given some partition scheme (ClusterSet(TInstance)).
	SilhouetteCoefficient(TInstance)	Implements an internal evaluation method that measures how similar an element is to its own cluster (cohesion) compared to other clusters (separation). The silhouette ranges from -1 to +1, where a high value indicates that the element is well matched to its own cluster and poorly matched to neighboring clusters. If most elements (average) have a high value, then the clustering configuration is appropriate. If the average is a low or negative value, then the clustering configuration may have too many or too few clusters.
	WithinBetweenRatio(TInstance)	Implements the within-between ratio (WB) internal evaluation method in [1] measuring the ratio of the sum-of-squares within cluster (SSW) and sum-of-squares between clusters (SSB). The result is multiplied by the negative of the number of clusters so that maximizing the ratio in some ClusteringResult(TInstance) provides the optimal partition, i.e., the optimal ClusterSet(TInstance) .
	XieBeniIndex(TInstance)	Implements the internal evaluation method in [1] known as the Xie-Beni (XB) index. It defines the inter-cluster separation as the minimum square distance between cluster centers, and the intra-cluster compactness as the mean square distance between each data object and its cluster center.
	XuIndex(TInstance)	Implements the Xu-index internal evaluation method proposed in [1] measuring the compactness of clusters given some partition scheme (ClusterSet(TInstance)). The higher the negative value of the Xu-index, the better the partition in some ClusteringResult(TInstance) is.

Interfaces

Interface	Description
 InternalEvaluationCriterion(TInstance)	Represents an interface for criteria which uses the internal information resulting from a AgglomerativeClusteringAlgorithm(TInstance) process to evaluate the goodness of a clustering structure without reference to external information. Implementations should be created so that when the criterion is maximized for a given

		ClusteringResult(TInstance) 's partition scheme, it provides the best ClusterSet(TInstance) according to that criterion.
--	--	--

CalinskiHarabaszIndex(TInstance) Class

Implements the internal evaluation method in [1] that measures compactness and separation of clusters simultaneously. The numerator reflects the degree of separation in the way of how much the cluster centers are spread, and the denominator corresponds to compactness, to reflect how close the within-cluster objects are gathered around the cluster center.

Inheritance Hierarchy

[System.Object](#)

Aglomera.Evaluation.Internal.CalinskiHarabaszIndex(TInstance)

Namespace: [Agglomera.Evaluation.Internal](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public class CalinskiHarabaszIndex<TInstance> : IInternalEvaluationCriterion<TInstance>  
where TInstance : Object, IComparable<TInstance>
```

[View Source](#)


Type Parameters

TInstance


The type of instance considered.

The CalinskiHarabaszIndex(TInstance) type exposes the following members.

Constructors







	Name	Description
	CalinskiHarabaszIndex(TInstance)	Creates a new DaviesBouldinIndex(TInstance) with given dissimilarity metric.

Properties

	Name	Description
	DissimilarityMetric	Gets the metric used by this criterion to measure the dissimilarity / distance between cluster elements.

Methods

	Name	Description
	Equals	(Inherited from Object .)

	Evaluate	Evaluates the given ClusterSet(TInstance) partition according to this evaluation criterion.
	Finalize	(Inherited from Object .)
	GetHashCode	(Inherited from Object .)
	GetType	(Inherited from Object .)
	MemberwiseClone	(Inherited from Object .)
	ToString	(Inherited from Object .)

Remarks

References: [1] - [Caliński, T., & Harabasz, J. \(1974\). A dendrite method for cluster analysis. Communications in Statistics-theory and Methods, 3\(1\), 1-27.](#)

See Also

[Agglomera.Evaluation.Internal Namespace](#)

CalinskiHarabaszIndex(TInstance) Constructor

Creates a new [DaviesBouldinIndex\(TInstance\)](#) with given dissimilarity metric.

Namespace: [Aglomera.Evaluation.Internal](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
public CalinskiHarabaszIndex(  
    IDissimilarityMetric<TInstance> dissimilarityMetric,  
    CentroidFunction<TInstance> centroidFunc  
)
```

[View Source](#)

Parameters

dissimilarityMetric

Type: [Aglomera.IDissimilarityMetric\(TInstance\)](#)

The metric used to calculate dissimilarity between cluster elements.

centroidFunc

Type: [Aglomera.CentroidFunction\(TInstance\)](#)

A function to get an element representing the centroid of a [Cluster\(TInstance\)](#).

See Also


[CalinskiHarabaszIndex\(TInstance\)Class](#)

[Aglomera.Evaluation.Internal Namespace](#)

CalinskiHarabaszIndex(TInstance).CalinskiHarabaszIndex(TInstance) Properties

The [CalinskiHarabaszIndex\(TInstance\)](#) generic type exposes the following members.

Properties

	Name	Description
	DissimilarityMetric	Gets the metric used by this criterion to measure the dissimilarity / distance between cluster elements.

See Also

[CalinskiHarabaszIndex\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

CalinskiHarabaszIndex(TInstance).DissimilarityMetric Property

Gets the metric used by this criterion to measure the dissimilarity / distance between cluster elements.

Namespace: [Agglomera.Evaluation.Internal](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
public IDissimilarityMetric<TInstance> DissimilarityMetric { get; }
```

[View Source](#)

Property Value

Type: [IDissimilarityMetric](#)(TInstance)

Implements

[IInternalEvaluationCriterion\(TInstance\).DissimilarityMetric](#)

See Also








[CalinskiHarabaszIndex\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

CalinskiHarabaszIndex(TInstance).CalinskiHarabaszIndex(TInstance) Methods

The [CalinskiHarabaszIndex\(TInstance\)](#) generic type exposes the following members.

Methods

	Name	Description
	Equals	(Inherited from Object .)
	Evaluate	Evaluates the given ClusterSet(TInstance) partition according to this evaluation criterion.
	Finalize	(Inherited from Object .)
	GetHashCode	(Inherited from Object .)
	GetType	(Inherited from Object .)
	MemberwiseClone	(Inherited from Object .)
	ToString	(Inherited from Object .)

See Also

[CalinskiHarabaszIndex\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

CalinskiHarabaszIndex(TInstance).Evaluate Method

Evaluates the given [ClusterSet\(TInstance\)](#) partition according to this evaluation criterion.

Namespace: [Agglomera.Evaluation.Internal](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public double Evaluate(  
    ClusterSet<TInstance> clusterSet  
)
```

[View Source](#)

Parameters

clusterSet

Type: [Agglomera.ClusterSet\(TInstance\)](#)

The clustering partition.

Return Value

Type: [Double](#)

The evaluation of the given partition according to this criterion.

Implements

[InternalEvaluationCriterion\(TInstance\).Evaluate\(ClusterSet\(TInstance\)\)](#)

See Also

[CalinskiHarabaszIndex\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

CombinedInternalCriterion(TInstance) Class

Implements an internal clustering evaluation criterion as a combination (weighted average) of other [InternalEvaluationCriterion\(TInstance\)](#).

Inheritance Hierarchy

[System.Object](#)

Aglomera.Evaluation.Internal.CombinedInternalCriterion(TInstance)

Namespace: [Agglomera.Evaluation.Internal](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

C#

```
public class CombinedInternalCriterion<TInstance> : InternalEvaluationCriterion<TInstance>
where TInstance : Object, IComparable<TInstance>
```

[View Source](#)


Type Parameters

TInstance


The type of instance considered.

The CombinedInternalCriterion(TInstance) type exposes the following members.




Constructors





Name	Description
 CombinedInternalCriterion(TInstance)	Creates a new CombinedInternalCriterion(TInstance) according to the given criteria and respective weights.

Properties

Name	Description
 DissimilarityMetric	Gets the metric used by this criterion to measure the dissimilarity / distance between cluster elements.

Methods

Name	Description
 Equals	(Inherited from Object .)
 Evaluate	Evaluates the given ClusterSet(TInstance) partition according to this evaluation criterion.
 Finalize	(Inherited from Object .)

 GetHashCode	(Inherited from Object.)
 GetType	(Inherited from Object.)
 MemberwiseClone	(Inherited from Object.)
 ToString	(Inherited from Object.)

See Also

[Agglomera.Evaluation.Internal Namespace](#)

CombinedInternalCriterion(TInstance) Constructor

Creates a new [CombinedInternalCriterion\(TInstance\)](#) according to the given criteria and respective weights.

Namespace: [Agglomera.Evaluation.Internal](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
public CombinedInternalCriterion(  
    IDictionary<IInternalEvaluationCriterion<TInstance>, double> criteria  
)
```

[View Source](#)

Parameters

criteria

Type: [System.Collections.Generic.IDictionary\(IInternalEvaluationCriterion\(TInstance\), Double\)](#)

A dictionary containing the several criteria to be used and how should they be combined, i.e., their associated weights.

See Also


[CombinedInternalCriterion\(TInstance\) Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

CombinedInternalCriterion(TInstance).CombinedInternalCriterion(TInstance) Properties

The [CombinedInternalCriterion\(TInstance\)](#) generic type exposes the following members.

Properties

	Name	Description
	DissimilarityMetric	Gets the metric used by this criterion to measure the dissimilarity / distance between cluster elements.

See Also

[CombinedInternalCriterion\(TInstance\) Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

CombinedInternalCriterion(TInstance).DissimilarityMetric Property

Gets the metric used by this criterion to measure the dissimilarity / distance between cluster elements.

Namespace: [Agglomera.Evaluation.Internal](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

C#

```
public IDissimilarityMetric<TInstance> DissimilarityMetric { get; }
```

[View Source](#)

Property Value

Type: [IDissimilarityMetric](#)(TInstance)

Implements

[IInternalEvaluationCriterion\(TInstance\).DissimilarityMetric](#)

See Also








[CombinedInternalCriterion\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

CombinedInternalCriterion(TInstance).CombinedInternalCriterion(TInstance) Methods

The [CombinedInternalCriterion\(TInstance\)](#) generic type exposes the following members.

Methods

	Name	Description
	Equals	(Inherited from Object .)
	Evaluate	Evaluates the given ClusterSet(TInstance) partition according to this evaluation criterion.
	Finalize	(Inherited from Object .)
	GetHashCode	(Inherited from Object .)
	GetType	(Inherited from Object .)
	MemberwiseClone	(Inherited from Object .)
	ToString	(Inherited from Object .)

See Also

[CombinedInternalCriterion\(TInstance\) Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

CombinedInternalCriterion(TInstance).Evaluate Method

Evaluates the given [ClusterSet\(TInstance\)](#) partition according to this evaluation criterion.

Namespace: [Agglomera.Evaluation.Internal](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public double Evaluate(  
    ClusterSet<TInstance> clusterSet  
)
```

[View Source](#)

Parameters

clusterSet

Type: [Agglomera.ClusterSet\(TInstance\)](#)

The clustering partition.

Return Value

Type: [Double](#)

The evaluation of the given partition according to this criterion.

Implements

[IInternalEvaluationCriterion\(TInstance\).Evaluate\(ClusterSet\(TInstance\)\)](#)

See Also

[CombinedInternalCriterion\(TInstance\) Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

DaviesBouldinIndex(TInstance) Class

Implements the internal evaluation method in [1] that measures the "ratio of the within cluster scatter to the between cluster separation" [2].

Inheritance Hierarchy

[System.Object](#)

Aglomera.Evaluation.Internal.DaviesBouldinIndex(TInstance)

Namespace: [Agglomera.Evaluation.Internal](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

C#

```
public class DaviesBouldinIndex<TInstance> : InternalEvaluationCriterion<TInstance>
where TInstance : Object, IComparable<TInstance>
```

[View Source](#)


Type Parameters

TInstance



The type of instance considered.

The DaviesBouldinIndex(TInstance) type exposes the following members.



Constructors






Name	Description
 DaviesBouldinIndex(TInstance)	Creates a new DaviesBouldinIndex(TInstance) with given dissimilarity metric.

Properties

Name	Description
 DissimilarityMetric	Gets the metric used by this criterion to measure the dissimilarity / distance between cluster elements.
 DistanceExponent	Gets or sets the distance exponent.

Methods

Name	Description
 Equals	(Inherited from Object .)
 Evaluate	Evaluates the given ClusterSet(TInstance) partition according to this evaluation criterion.

 Finalize	(Inherited from Object.)
 GetHashCode	(Inherited from Object.)
 GetType	(Inherited from Object.)
 MemberwiseClone	(Inherited from Object.)
 ToString	(Inherited from Object.)

Remarks

"It happens to be the average similarity between each cluster and its most similar one, averaged over all the clusters[...]. This affirms the idea that no cluster has to be similar to another, and hence the best clustering scheme essentially minimizes the Davies–Bouldin (BD) index" [2]. Notes: - This implementation corresponds to - BD so that a higher index provides a better partitioning. - This implementation returns `double.NaN` if the partition contains singleton clusters (undefined dispersion).

References: [1] - [Davies, D. L., & Bouldin, D. W. \(1979\). A cluster separation measure. IEEE transactions on pattern analysis and machine intelligence, \(2\), 224-227.](#) [2] - https://en.wikipedia.org/wiki/Davies%E2%80%93Bouldin_index

See Also

[Agglomera.Evaluation.Internal Namespace](#)

DaviesBouldinIndex(TInstance) Constructor

Creates a new [DaviesBouldinIndex\(TInstance\)](#) with given dissimilarity metric.

Namespace: [Agglomera.Evaluation.Internal](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public DaviesBouldinIndex(  
    IDissimilarityMetric<TInstance> dissimilarityMetric,  
    CentroidFunction<TInstance> centroidFunc  
)
```

[View Source](#)

Parameters

dissimilarityMetric

Type: [Agglomera.IDissimilarityMetric\(TInstance\)](#)

The metric used to calculate dissimilarity between cluster elements.

centroidFunc

Type: [Agglomera.CentroidFunction\(TInstance\)](#)

A function to get an element representing the centroid of a [Cluster\(TInstance\)](#).

See Also



[DaviesBouldinIndex\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

DaviesBouldinIndex(TInstance).DaviesBouldinIndex(TInstance) Properties

The [DaviesBouldinIndex\(TInstance\)](#) generic type exposes the following members.

Properties

	Name	Description
	DissimilarityMetric	Gets the metric used by this criterion to measure the dissimilarity / distance between cluster elements.
	DistanceExponent	Gets or sets the distance exponent.

See Also

[DaviesBouldinIndex\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

DaviesBouldinIndex(TInstance).DissimilarityMetric Property

Gets the metric used by this criterion to measure the dissimilarity / distance between cluster elements.

Namespace: [Agglomera.Evaluation.Internal](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
public IDissimilarityMetric<TInstance> DissimilarityMetric { get; }
```

[View Source](#)

Property Value

Type: [IDissimilarityMetric](#)(TInstance)

Implements

[IInternalEvaluationCriterion\(TInstance\).DissimilarityMetric](#)

See Also

[DaviesBouldinIndex\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

DaviesBouldinIndex(TInstance).DistanceExponent Property

Gets or sets the distance exponent.

Namespace: [Agglomera.Evaluation.Internal](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

C#

```
public double DistanceExponent { get; set; }
```

[View Source](#)

Property Value

Type: [Double](#)

See Also

[DaviesBouldinIndex\(TInstance\)Class](#)








[Agglomera.Evaluation.Internal Namespace](#)

DaviesBouldinIndex(TInstance).DaviesBouldinIndex(TInstance)

Methods

The [DaviesBouldinIndex\(TInstance\)](#) generic type exposes the following members.

Methods

	Name	Description
	Equals	(Inherited from Object .)
	Evaluate	Evaluates the given ClusterSet(TInstance) partition according to this evaluation criterion.
	Finalize	(Inherited from Object .)
	GetHashCode	(Inherited from Object .)
	GetType	(Inherited from Object .)
	MemberwiseClone	(Inherited from Object .)
	ToString	(Inherited from Object .)

See Also

[DaviesBouldinIndex\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

DaviesBouldinIndex(TInstance).Evaluate Method

Evaluates the given [ClusterSet\(TInstance\)](#) partition according to this evaluation criterion.

Namespace: [Agglomera.Evaluation.Internal](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public double Evaluate(  
    ClusterSet<TInstance> clusterSet  
)
```

[View Source](#)

Parameters

clusterSet

Type: [Agglomera.ClusterSet\(TInstance\)](#)

The clustering partition.

Return Value

Type: [Double](#)

The evaluation of the given partition according to this criterion.

Implements

[InternalEvaluationCriterion\(TInstance\).Evaluate\(ClusterSet\(TInstance\)\)](#)

See Also

[DaviesBouldinIndex\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

DunnIndex(TInstance) Class

Implements the internal evaluation method in [1] that measures the ratio between the smallest distance between observations not in the same cluster to the largest intra-cluster distance. The Dunn Index has a value between zero and infinity, and a higher index indicates a better clustering. The aim is to identify sets of clusters that are compact, with a small variance between members of the cluster, and well separated, where the means of different clusters are sufficiently far apart, as compared to the within cluster variance [2].

Inheritance Hierarchy

[System.Object](#)

Aglomera.Evaluation.Internal.DunnIndex(TInstance)

Namespace: [Agglomera.Evaluation.Internal](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

C#

```
public class DunnIndex<TInstance> : InternalEvaluationCriterion<TInstance>
where TInstance : Object, IComparable<TInstance>
```

[View Source](#)

Type Parameters

TInstance


The type of instance considered.

The DunnIndex(TInstance) type exposes the following members.

Constructors







	Name	Description
	DunnIndex(TInstance)	Creates a new DunnIndex(TInstance) with given dissimilarity metric.

Properties

	Name	Description
	DissimilarityMetric	Gets the metric used by this criterion to measure the dissimilarity / distance between cluster elements.

Methods

	Name	Description
	Equals	(Inherited from Object .)

	Evaluate	Evaluates the given ClusterSet(TInstance) partition according to this evaluation criterion.
	Finalize	(Inherited from Object.)
	GetHashCode	(Inherited from Object.)
	GetType	(Inherited from Object.)
	MemberwiseClone	(Inherited from Object.)
	ToString	(Inherited from Object.)

Remarks

Notes: - This formulation has a peculiar problem, in that if one of the clusters is badly behaved, where the others are tightly packed, since the denominator contains a 'max' term instead of an average term, the Dunn Index for that set of clusters will be uncharacteristically low [2]. References: [1] - [Dunn, J. C. \(1973\). A fuzzy relative of the ISODATA process and its use in detecting compact well-separated clusters.](#) [2] - https://en.wikipedia.org/wiki/Dunn_index

See Also

[Agglomera.Evaluation.Internal Namespace](#)

DunnIndex(TInstance) Constructor

Creates a new [DunnIndex\(TInstance\)](#) with given dissimilarity metric.

Namespace: [Agglomera.Evaluation.Internal](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public DunnIndex(  
    IDissimilarityMetric<TInstance> dissimilarityMetric  
)
```

[View Source](#)

Parameters

dissimilarityMetric

Type: [Agglomera.IDissimilarityMetric\(TInstance\)](#)

The metric used to calculate dissimilarity between cluster elements.

See Also


[DunnIndex\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

DunnIndex(TInstance).DunnIndex(TInstance) Properties

The [DunnIndex\(TInstance\)](#) generic type exposes the following members.

Properties

	Name	Description
	DissimilarityMetric	Gets the metric used by this criterion to measure the dissimilarity / distance between cluster elements.

See Also

[DunnIndex\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

DunnIndex(TInstance).DissimilarityMetric Property

Gets the metric used by this criterion to measure the dissimilarity / distance between cluster elements.

Namespace: [Agglomera.Evaluation.Internal](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
public IDissimilarityMetric<TInstance> DissimilarityMetric { get; }
```

[View Source](#)

Property Value

Type: [IDissimilarityMetric](#)(TInstance)

Implements

[IInternalEvaluationCriterion](#)(TInstance).DissimilarityMetric

See Also








[DunnIndex\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

DunnIndex(TInstance).DunnIndex(TInstance) Methods

The [DunnIndex\(TInstance\)](#) generic type exposes the following members.

Methods

	Name	Description
	Equals	(Inherited from Object .)
	Evaluate	Evaluates the given ClusterSet(TInstance) partition according to this evaluation criterion.
	Finalize	(Inherited from Object .)
	GetHashCode	(Inherited from Object .)
	GetType	(Inherited from Object .)
	MemberwiseClone	(Inherited from Object .)
	ToString	(Inherited from Object .)

See Also

[DunnIndex\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

DunnIndex(TInstance).Evaluate Method

Evaluates the given [ClusterSet\(TInstance\)](#) partition according to this evaluation criterion.

Namespace: [Agglomera.Evaluation.Internal](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public double Evaluate(  
    ClusterSet<TInstance> clusterSet  
)
```

[View Source](#)

Parameters

clusterSet

Type: [Agglomera.ClusterSet\(TInstance\)](#)

The clustering partition.

Return Value

Type: [Double](#)

The evaluation of the given partition according to this criterion.

Implements

[IInternalEvaluationCriterion\(TInstance\).Evaluate\(ClusterSet\(TInstance\)\)](#)

See Also

[DunnIndex\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

IIndex(TInstance) Class

Implements the I-index internal evaluation method [1] that uses the ratio of the separation and compactness of a given clustering partition scheme. To measure separation, it adopts the maximum distance between cluster centers and for compactness, the distance from an to its cluster center.

Inheritance Hierarchy

[System.Object](#)

Aglomera.Evaluation.Internal.IIndex(TInstance)

Namespace: [Agglomera.Evaluation.Internal](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public class IIndex<TInstance> : IInternalEvaluationCriterion<TInstance>  
where TInstance : Object, IComparable<TInstance>
```

[View Source](#)


Type Parameters

TInstance


The type of instance considered.

The IIndex(TInstance) type exposes the following members.




Constructors





	Name	Description
	IIndex(TInstance)	Creates a new IIndex(TInstance) with given dissimilarity metric.

Properties

	Name	Description
	DissimilarityMetric	Gets the metric used by this criterion to measure the dissimilarity / distance between cluster elements.

Methods

	Name	Description
	Equals	(Inherited from Object .)
	Evaluate	Evaluates the given ClusterSet(TInstance) partition according to this evaluation criterion.
	Finalize	(Inherited from Object .)

	GetHashCode	(Inherited from Object.)
	GetType	(Inherited from Object.)
	MemberwiseClone	(Inherited from Object.)
	ToString	(Inherited from Object.)

Remarks

References: [1] - [Maulik, U., & Bandyopadhyay, S. \(2002\). Performance evaluation of some clustering algorithms and validity indices. IEEE Transactions on Pattern Analysis and Machine Intelligence, 24\(12\), 1650-1654.](#)

See Also

[Agglomera.Evaluation.Internal Namespace](#)

IIndex(TInstance) Constructor

Creates a new [IIndex\(TInstance\)](#) with given dissimilarity metric.

Namespace: [Agglomera.Evaluation.Internal](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public IIndex(  
    IDissimilarityMetric<TInstance> dissimilarityMetric,  
    CentroidFunction<TInstance> centroidFunc  
)
```

[View Source](#)

Parameters

dissimilarityMetric

Type: [Agglomera.IDissimilarityMetric\(TInstance\)](#)

The metric used to calculate dissimilarity between cluster elements.

centroidFunc

Type: [Agglomera.CentroidFunction\(TInstance\)](#)

A function to get an element representing the centroid of a [Cluster\(TInstance\)](#).

See Also


[IIndex\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

[IIndex\(TInstance\).IIndex\(TInstance\) Properties](#)

The [IIndex\(TInstance\)](#) generic type exposes the following members.

Properties

	Name	Description
	DissimilarityMetric	Gets the metric used by this criterion to measure the dissimilarity / distance between cluster elements.

See Also

[IIndex\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

IIndex(TInstance).DissimilarityMetric Property

Gets the metric used by this criterion to measure the dissimilarity / distance between cluster elements.

Namespace: [Agglomera.Evaluation.Internal](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
public IDissimilarityMetric<TInstance> DissimilarityMetric { get; }
```

[View Source](#)

Property Value

Type: [IDissimilarityMetric](#)(TInstance)

Implements

[IInternalEvaluationCriterion\(TInstance\).DissimilarityMetric](#)

See Also








[IIndex\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

`IIndex(TInstance).IIndex(TInstance)` Methods

The [IIndex\(TInstance\)](#) generic type exposes the following members.

Methods

	Name	Description
	Equals	(Inherited from Object .)
	Evaluate	Evaluates the given ClusterSet(TInstance) partition according to this evaluation criterion.
	Finalize	(Inherited from Object .)
	GetHashCode	(Inherited from Object .)
	GetType	(Inherited from Object .)
	MemberwiseClone	(Inherited from Object .)
	ToString	(Inherited from Object .)

See Also

[IIndex\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

`IIndex(TInstance).Evaluate` Method

Evaluates the given [ClusterSet\(TInstance\)](#) partition according to this evaluation criterion.

Namespace: [Agglomera.Evaluation.Internal](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public double Evaluate(  
    ClusterSet<TInstance> clusterSet  
)
```

[View Source](#)

Parameters

clusterSet

Type: [Agglomera.ClusterSet\(TInstance\)](#)

The clustering partition.

Return Value

Type: [Double](#)

The evaluation of the given partition according to this criterion.

Implements

[IInternalEvaluationCriterion\(TInstance\).Evaluate\(ClusterSet\(TInstance\)\)](#)

See Also

[IIndex\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

InternalEvaluationCriterion(TInstance) Interface

Represents an interface for criteria which uses the internal information resulting from a [AgglomerativeClusteringAlgorithm\(TInstance\)](#) process to evaluate the goodness of a clustering structure without reference to external information. Implementations should be created so that when the criterion is **maximized** for a given [ClusteringResult\(TInstance\)](#)'s partition scheme, it provides the best [ClusterSet\(TInstance\)](#) according to that criterion.

Namespace: [Agglomera.Evaluation.Internal](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public interface InternalEvaluationCriterion<TInstance>  
where TInstance : Object, IComparable<TInstance>
```

[View Source](#)


Type Parameters

TInstance


The type of instance considered.

The `InternalEvaluationCriterion(TInstance)` type exposes the following members.

Properties

	Name	Description
	DissimilarityMetric	Gets the metric used by this criterion to measure the dissimilarity / distance between cluster elements.

Methods

	Name	Description
	Evaluate	Evaluates the given ClusterSet(TInstance) partition according to this evaluation criterion.

Remarks

These methods are useful for estimating the number of clusters to group data after executing the clustering algorithm without any external data.


See Also

[Agglomera.Evaluation.Internal Namespace](#)

[InternalEvaluationCriterion\(TInstance\).InternalEvaluationCriterion\(TInstance\)](#) Properties

The [InternalEvaluationCriterion\(TInstance\)](#) generic type exposes the following members.

Properties

	Name	Description
	DissimilarityMetric	Gets the metric used by this criterion to measure the dissimilarity / distance between cluster elements.

See Also

[InternalEvaluationCriterion\(TInstance\)Interface](#)

[Agglomera.Evaluation.Internal Namespace](#)

InternalEvaluationCriterion(TInstance).DissimilarityMetric Property

Gets the metric used by this criterion to measure the dissimilarity / distance between cluster elements.

Namespace: [Agglomera.Evaluation.Internal](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

C#

```
IDissimilarityMetric<TInstance> DissimilarityMetric { get; }
```

[View Source](#)

Property Value

Type: [IDissimilarityMetric](#)(TInstance)

See Also

[InternalEvaluationCriterion\(TInstance\)Interface](#)

[Agglomera.Evaluation.Internal Namespace](#)

[InternalEvaluationCriterion\(TInstance\).InternalEvaluationCriterion\(TInstance\) Methods](#)

The [InternalEvaluationCriterion\(TInstance\)](#) generic type exposes the following members.

Methods

	Name	Description
	Evaluate	Evaluates the given ClusterSet(TInstance) partition according to this evaluation criterion.

See Also

[InternalEvaluationCriterion\(TInstance\)Interface](#)

[Aglomera.Evaluation.Internal Namespace](#)

InternalEvaluationCriterion(TInstance).Evaluate Method

Evaluates the given [ClusterSet\(TInstance\)](#) partition according to this evaluation criterion.

Namespace: [Agglomera.Evaluation.Internal](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
double Evaluate(  
    ClusterSet<TInstance> clusterSet  
)
```

[View Source](#)

Parameters

clusterSet

Type: [Agglomera.ClusterSet](#)(TInstance)

The clustering partition.

Return Value

Type: [Double](#)

The evaluation of the given partition according to this criterion.

See Also

[InternalEvaluationCriterion\(TInstance\)Interface](#)

[Agglomera.Evaluation.Internal Namespace](#)

ModifiedGammaStatistic(TInstance) Class

Implements an internal evaluation method based on a modified/improved version of Hubert's Gamma (Γ) statistic in [1] with the transformation introduced in [2] in order to be maximized.

Inheritance Hierarchy

[System.Object](#)

Aglomera.Evaluation.Internal.ModifiedGammaStatistic(TInstance)

Namespace: [Agglomera.Evaluation.Internal](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

C#

```
public class ModifiedGammaStatistic<TInstance> : IInternalEvaluationCriterion<TInstance>
where TInstance : Object, IComparable<TInstance>
```

[View Source](#)


Type Parameters

TInstance


The type of instance considered.

The ModifiedGammaStatistic(TInstance) type exposes the following members.




Constructors





Name	Description
 ModifiedGammaStatistic(TInstance)	Creates a new ModifiedGammaStatistic(TInstance) with given dissimilarity metric.

Properties

Name	Description
 DissimilarityMetric	Gets the metric used by this criterion to measure the dissimilarity / distance between cluster elements.

Methods

Name	Description
 Equals	(Inherited from Object .)
 Evaluate	Evaluates the given ClusterSet(TInstance) partition according to this evaluation criterion.
 Finalize	(Inherited from Object .)

	GetHashCode	(Inherited from Object.)
	GetType	(Inherited from Object.)
	MemberwiseClone	(Inherited from Object.)
	ToString	(Inherited from Object.)

Remarks

Notes: - "The improved Hubert Γ statistic describes the degree of a partition fitting the data set. [...] The partition number fitting data set may be discovered from the plot of Γ versus n , however, it is difficult to find the inflexion from the plot and it is possible that the partition number obtained is just close to the best solution, but not that we want. So, it is not feasible in practice to determine the optimal partition by the plot of Γ versus n directly. [...] In the plot of [transformed Γ] versus [number of clusters c], Γ goes to zero with c close to n , and a max peak value that corresponds to a significant increase of c can be found. The number of clusters at which the peak value occurs is equal to the number of clusters fitting the data." [2] References: [1] - [Hubert, L., & Arabie, P. \(1985\). Comparing partitions. Journal of classification, 2\(1\), 193-218.](#) [2] - [Zhao, H., Liang, J., & Hu, H. \(2006, August\). Clustering Validity Based on the Improved Hubert\Gamma Statistic and the Separation of Clusters. In First International Conference on Innovative Computing, Information and Control, 2006. ICICIC'06. \(Vol. 2, pp. 539-543\). IEEE.](#)

See Also

[Agglomera.Evaluation.Internal Namespace](#)

ModifiedGammaStatistic(TInstance) Constructor

Creates a new [ModifiedGammaStatistic\(TInstance\)](#) with given dissimilarity metric.

Namespace: [Agglomera.Evaluation.Internal](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public ModifiedGammaStatistic(  
    IDissimilarityMetric<TInstance> dissimilarityMetric,  
    CentroidFunction<TInstance> centroidFunc  
)
```

[View Source](#)

Parameters

dissimilarityMetric

Type: [Agglomera.IDissimilarityMetric\(TInstance\)](#)

The metric used to calculate dissimilarity between cluster elements.

centroidFunc

Type: [Agglomera.CentroidFunction\(TInstance\)](#)

A function to get an element representing the centroid of a [Cluster\(TInstance\)](#).

See Also


[ModifiedGammaStatistic\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

ModifiedGammaStatistic(TInstance).ModifiedGammaStatistic(TInstance) Properties

The [ModifiedGammaStatistic\(TInstance\)](#) generic type exposes the following members.

Properties

	Name	Description
	DissimilarityMetric	Gets the metric used by this criterion to measure the dissimilarity / distance between cluster elements.

See Also

[ModifiedGammaStatistic\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

ModifiedGammaStatistic(TInstance).DissimilarityMetric Property

Gets the metric used by this criterion to measure the dissimilarity / distance between cluster elements.

Namespace: [Agglomera.Evaluation.Internal](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
public IDissimilarityMetric<TInstance> DissimilarityMetric { get; }
```

[View Source](#)

Property Value

Type: [IDissimilarityMetric](#)(TInstance)

Implements

[IInternalEvaluationCriterion](#)(TInstance).DissimilarityMetric

See Also








[ModifiedGammaStatistic\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

ModifiedGammaStatistic(TInstance).ModifiedGammaStatistic(TInstance) Methods

The [ModifiedGammaStatistic\(TInstance\)](#) generic type exposes the following members.

Methods

	Name	Description
	Equals	(Inherited from Object .)
	Evaluate	Evaluates the given ClusterSet(TInstance) partition according to this evaluation criterion.
	Finalize	(Inherited from Object .)
	GetHashCode	(Inherited from Object .)
	GetType	(Inherited from Object .)
	MemberwiseClone	(Inherited from Object .)
	ToString	(Inherited from Object .)

See Also

[ModifiedGammaStatistic\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

ModifiedGammaStatistic(TInstance).Evaluate Method

Evaluates the given [ClusterSet\(TInstance\)](#) partition according to this evaluation criterion.

Namespace: [Agglomera.Evaluation.Internal](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public double Evaluate(  
    ClusterSet<TInstance> clusterSet  
)
```

[View Source](#)

Parameters

clusterSet

Type: [Agglomera.ClusterSet\(TInstance\)](#)

The clustering partition.

Return Value

Type: [Double](#)

The evaluation of the given partition according to this criterion.

Implements

[InternalEvaluationCriterion\(TInstance\).Evaluate\(ClusterSet\(TInstance\)\)](#)

See Also

[ModifiedGammaStatistic\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

RootMeanSquareStdDev(TInstance) Class

Implements an internal evaluation method measuring the root-mean-square standard deviation (RMSSD), i.e., the square root of the variance between all elements. This criterion considers only the compactness of the clustering partition.

Inheritance Hierarchy

[System.Object](#)

Aglomera.Evaluation.Internal.RootMeanSquareStdDev(TInstance)

Namespace: [Agglomera.Evaluation.Internal](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public class RootMeanSquareStdDev<TInstance> : InternalEvaluationCriterion<TInstance>  
where TInstance : Object, IComparable<TInstance>
```

[View Source](#)


Type Parameters

TInstance


The type of instance considered.

The RootMeanSquareStdDev(TInstance) type exposes the following members.



Constructors






Name	Description
 RootMeanSquareStdDev(TInstance)	Creates a new RootMeanSquareStdDev(TInstance) with given dissimilarity metric.

Properties

Name	Description
 DissimilarityMetric	Gets the metric used by this criterion to measure the dissimilarity / distance between cluster elements.

Methods

Name	Description
 Equals	(Inherited from Object .)
 Evaluate	Evaluates the given ClusterSet(TInstance) partition according to this evaluation criterion.

	Finalize	(Inherited from Object.)
	GetHashCode	(Inherited from Object.)
	GetType	(Inherited from Object.)
	MemberwiseClone	(Inherited from Object.)
	ToString	(Inherited from Object.)

Remarks

In order to select the optimal partition / [ClusterSet\(TInstance\)](#) using this criterion given some [ClusteringResult\(TInstance\)](#) one has to find the 'knee' in the plot of the criterion value vs. the number of clusters.

See Also

[Agglomera.Evaluation.Internal Namespace](#)

RootMeanSquareStdDev(TInstance) Constructor

Creates a new [RootMeanSquareStdDev\(TInstance\)](#) with given dissimilarity metric.

Namespace: [Agglomera.Evaluation.Internal](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public RootMeanSquareStdDev(  
    IDissimilarityMetric<TInstance> dissimilarityMetric,  
    CentroidFunction<TInstance> centroidFunc  
)
```

[View Source](#)

Parameters

dissimilarityMetric

Type: [Agglomera.IDissimilarityMetric\(TInstance\)](#)

The metric used to calculate dissimilarity between cluster elements.

centroidFunc

Type: [Agglomera.CentroidFunction\(TInstance\)](#)

A function to get an element representing the centroid of a [Cluster\(TInstance\)](#).

See Also


[RootMeanSquareStdDev\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

RootMeanSquareStdDev(TInstance).RootMeanSquareStdDev(TInstance) Properties

The [RootMeanSquareStdDev\(TInstance\)](#) generic type exposes the following members.

Properties

	Name	Description
	DissimilarityMetric	Gets the metric used by this criterion to measure the dissimilarity / distance between cluster elements.

See Also

[RootMeanSquareStdDev\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

RootMeanSquareStdDev(TInstance).DissimilarityMetric Property

Gets the metric used by this criterion to measure the dissimilarity / distance between cluster elements.

Namespace: [Agglomera.Evaluation.Internal](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
public IDissimilarityMetric<TInstance> DissimilarityMetric { get; }
```

[View Source](#)

Property Value

Type: [IDissimilarityMetric](#)(TInstance)

Implements

[IInternalEvaluationCriterion](#)(TInstance).DissimilarityMetric

See Also








[RootMeanSquareStdDev\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

RootMeanSquareStdDev(TInstance).RootMeanSquareStdDev(TInstance) Methods

The [RootMeanSquareStdDev\(TInstance\)](#) generic type exposes the following members.

Methods

	Name	Description
	Equals	(Inherited from Object .)
	Evaluate	Evaluates the given ClusterSet(TInstance) partition according to this evaluation criterion.
	Finalize	(Inherited from Object .)
	GetHashCode	(Inherited from Object .)
	GetType	(Inherited from Object .)
	MemberwiseClone	(Inherited from Object .)
	ToString	(Inherited from Object .)

See Also

[RootMeanSquareStdDev\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

RootMeanSquareStdDev(TInstance).Evaluate Method

Evaluates the given [ClusterSet\(TInstance\)](#) partition according to this evaluation criterion.

Namespace: [Agglomera.Evaluation.Internal](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public double Evaluate(  
    ClusterSet<TInstance> clusterSet  
)
```

[View Source](#)

Parameters

clusterSet

Type: [Agglomera.ClusterSet\(TInstance\)](#)

The clustering partition.

Return Value

Type: [Double](#)

The evaluation of the given partition according to this criterion.

Implements

[InternalEvaluationCriterion\(TInstance\).Evaluate\(ClusterSet\(TInstance\)\)](#)

See Also

[RootMeanSquareStdDev\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

RSquared(TInstance) Class

Implements an internal evaluation method measuring the complement of the ratio of the sum of squared distances between elements in different clusters to the total sum of squares. This criterion considers only the separation between the clusters given some partition scheme ([ClusterSet\(TInstance\)](#)).

Inheritance Hierarchy

[System.Object](#)

Aglomera.Evaluation.Internal.RSquared(TInstance)

Namespace: [Agglomera.Evaluation.Internal](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public class RSquared<TInstance> : InternalEvaluationCriterion<TInstance>  
where TInstance : Object, IComparable<TInstance>
```

[View Source](#)


Type Parameters

TInstance


The type of instance considered.

The RSquared(TInstance) type exposes the following members.



Constructors






	Name	Description
	RSquared(TInstance)	Creates a new RSquared(TInstance) with given dissimilarity metric.

Properties

	Name	Description
	DissimilarityMetric	Gets the metric used by this criterion to measure the dissimilarity / distance between cluster elements.

Methods

	Name	Description
	Equals	(Inherited from Object .)
	Evaluate	Evaluates the given ClusterSet(TInstance) partition according to this evaluation criterion.

	Finalize	(Inherited from Object.)
	GetHashCode	(Inherited from Object.)
	GetType	(Inherited from Object.)
	MemberwiseClone	(Inherited from Object.)
	ToString	(Inherited from Object.)

Remarks

In order to select the optimal partition / [ClusterSet\(TInstance\)](#) using this criterion given some [ClusteringResult\(TInstance\)](#) one has to find the 'knee' in the plot of the criterion value vs. the number of clusters.

See Also

[Agglomera.Evaluation.Internal Namespace](#)

RSquared(TInstance) Constructor

Creates a new [RSquared\(TInstance\)](#) with given dissimilarity metric.

Namespace: [Agglomera.Evaluation.Internal](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public RSquared(  
    IDissimilarityMetric<TInstance> dissimilarityMetric,  
    CentroidFunction<TInstance> centroidFunc  
)
```

[View Source](#)

Parameters

dissimilarityMetric

Type: [Agglomera.IDissimilarityMetric](#)(TInstance)

The metric used to calculate dissimilarity between cluster elements.

centroidFunc

Type: [Agglomera.CentroidFunction](#)(TInstance)

A function to get an element representing the centroid of a [Cluster\(TInstance\)](#).

See Also


[RSquared\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

RSquared(TInstance).RSquared(TInstance) Properties

The [RSquared\(TInstance\)](#) generic type exposes the following members.

Properties

	Name	Description
	DissimilarityMetric	Gets the metric used by this criterion to measure the dissimilarity / distance between cluster elements.

See Also

[RSquared\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

RSquared(TInstance).DissimilarityMetric Property

Gets the metric used by this criterion to measure the dissimilarity / distance between cluster elements.

Namespace: [Agglomera.Evaluation.Internal](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
public IDissimilarityMetric<TInstance> DissimilarityMetric { get; }
```

[View Source](#)

Property Value

Type: [IDissimilarityMetric](#)(TInstance)

Implements

[IInternalEvaluationCriterion](#)(TInstance).DissimilarityMetric

See Also








[RSquared\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

RSquared(TInstance).RSquared(TInstance) Methods

The [RSquared\(TInstance\)](#) generic type exposes the following members.

Methods

	Name	Description
	Equals	(Inherited from Object .)
	Evaluate	Evaluates the given ClusterSet(TInstance) partition according to this evaluation criterion.
	Finalize	(Inherited from Object .)
	GetHashCode	(Inherited from Object .)
	GetType	(Inherited from Object .)
	MemberwiseClone	(Inherited from Object .)
	ToString	(Inherited from Object .)

See Also

[RSquared\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

RSquared(TInstance).Evaluate Method

Evaluates the given [ClusterSet\(TInstance\)](#) partition according to this evaluation criterion.

Namespace: [Agglomera.Evaluation.Internal](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public double Evaluate(  
    ClusterSet<TInstance> clusterSet  
)
```

[View Source](#)

Parameters

clusterSet

Type: [Agglomera.ClusterSet\(TInstance\)](#)

The clustering partition.

Return Value

Type: [Double](#)

The evaluation of the given partition according to this criterion.

Implements

[IInternalEvaluationCriterion\(TInstance\).Evaluate\(ClusterSet\(TInstance\)\)](#)

See Also

[RSquared\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

SilhouetteCoefficient(TInstance) Class

Implements an internal evaluation method that measures how similar an element is to its own cluster (cohesion) compared to other clusters (separation). The silhouette ranges from -1 to $+1$, where a high value indicates that the element is well matched to its own cluster and poorly matched to neighboring clusters. If most elements (average) have a high value, then the clustering configuration is appropriate. If the average is a low or negative value, then the clustering configuration may have too many or too few clusters.

Inheritance Hierarchy

[System.Object](#)

Aglomera.Evaluation.Internal.SilhouetteCoefficient(TInstance)

Namespace: [Agglomera.Evaluation.Internal](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

C#

```
public class SilhouetteCoefficient<TInstance> : InternalEvaluationCriterion<TInstance>
where TInstance : Object, IComparable<TInstance>
```

[View Source](#)


Type Parameters

TInstance


The type of instance considered.

The SilhouetteCoefficient(TInstance) type exposes the following members.

Constructors








	Name	Description
	SilhouetteCoefficient(TInstance)	Creates a new SilhouetteCoefficient(TInstance) with given dissimilarity metric.

Properties

	Name	Description
	DissimilarityMetric	Gets the metric used by this criterion to measure the dissimilarity / distance between cluster elements.

Methods

	Name	Description
	Equals	(Inherited from Object .)

	Evaluate	Evaluates the given ClusterSet(TInstance) partition according to this evaluation criterion.
	EvaluateEach	Calculates the silhouette coefficient for each element in the given ClusterSet(TInstance) .
	Finalize	(Inherited from Object .)
	GetHashCode	(Inherited from Object .)
	GetType	(Inherited from Object .)
	MemberwiseClone	(Inherited from Object .)
	ToString	(Inherited from Object .)

Remarks

Assumptions in [2]: - "Note that the construction [...] depends on the availability of other clusters apart from A, so we have to assume [...] that the number of clusters k is more than one." - "When cluster A contains only a single object it is unclear how $u(i)$ should be defined, and then we simply set $s(i)$ equal to zero. This choice is of course arbitrary, but a value of zero appears to be most neutral." Therefore, Silhouette coefficient punishes outliers and noise, so in the presence of such data we should avoid it. References: [1] - [https://en.wikipedia.org/wiki/Silhouette_\(clustering\)](https://en.wikipedia.org/wiki/Silhouette_(clustering)) [2] - [Rousseeuw, P. J. \(1987\). Silhouettes: a graphical aid to the interpretation and validation of cluster analysis. Journal of computational and applied mathematics, 20, 53-65.](#)

See Also

[Agglomera.Evaluation.Internal Namespace](#)

SilhouetteCoefficient(TInstance) Constructor

Creates a new [SilhouetteCoefficient\(TInstance\)](#) with given dissimilarity metric.

Namespace: [Agglomera.Evaluation.Internal](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public SilhouetteCoefficient(  
    IDissimilarityMetric<TInstance> dissimilarityMetric  
)
```

[View Source](#)

Parameters

dissimilarityMetric

Type: [Aglomera.IDissimilarityMetric\(TInstance\)](#)

The metric used to calculate dissimilarity between cluster elements.

See Also


[SilhouetteCoefficient\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

SilhouetteCoefficient(TInstance).SilhouetteCoefficient(TInstance) Properties

The [SilhouetteCoefficient\(TInstance\)](#) generic type exposes the following members.

Properties

	Name	Description
	DissimilarityMetric	Gets the metric used by this criterion to measure the dissimilarity / distance between cluster elements.

See Also

[SilhouetteCoefficient\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

SilhouetteCoefficient(TInstance).DissimilarityMetric Property

Gets the metric used by this criterion to measure the dissimilarity / distance between cluster elements.

Namespace: [Agglomera.Evaluation.Internal](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

C#

```
public IDissimilarityMetric<TInstance> DissimilarityMetric { get; }
```

[View Source](#)

Property Value

Type: [IDissimilarityMetric](#)(TInstance)

Implements

[IInternalEvaluationCriterion\(TInstance\).DissimilarityMetric](#)

See Also









[SilhouetteCoefficient\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

SilhouetteCoefficient(TInstance).SilhouetteCoefficient(TInstance) Methods

The [SilhouetteCoefficient\(TInstance\)](#) generic type exposes the following members.

Methods

	Name	Description
	Equals	(Inherited from Object .)
	Evaluate	Evaluates the given ClusterSet(TInstance) partition according to this evaluation criterion.
	EvaluateEach	Calculates the silhouette coefficient for each element in the given ClusterSet(TInstance) .
	Finalize	(Inherited from Object .)
	GetHashCode	(Inherited from Object .)
	GetType	(Inherited from Object .)
	MemberwiseClone	(Inherited from Object .)
	ToString	(Inherited from Object .)

See Also

[SilhouetteCoefficient\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

SilhouetteCoefficient(TInstance).Evaluate Method

Evaluates the given [ClusterSet\(TInstance\)](#) partition according to this evaluation criterion.

Namespace: [Agglomera.Evaluation.Internal](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public double Evaluate(  
    ClusterSet<TInstance> clusterSet  
)
```

[View Source](#)

Parameters

clusterSet

Type: [Agglomera.ClusterSet\(TInstance\)](#)

The clustering partition.

Return Value

Type: [Double](#)

The evaluation of the given partition according to this criterion.

Implements

[IInternalEvaluationCriterion\(TInstance\).Evaluate\(ClusterSet\(TInstance\)\)](#)

See Also

[SilhouetteCoefficient\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

SilhouetteCoefficient(TInstance).EvaluateEach Method

Calculates the silhouette coefficient for each element in the given [ClusterSet\(TInstance\)](#).

Namespace: [Agglomera.Evaluation.Internal](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public IDictionary<TInstance, double> EvaluateEach(  
    ClusterSet<TInstance> clusterSet  
)
```

[View Source](#)

Parameters

clusterSet

Type: [Agglomera.ClusterSet](#)(*TInstance*)

The clustering partition.

Return Value

Type: [IDictionary](#)(*TInstance*, [Double](#))

A dictionary containing the silhouette coefficient for each element in the given partition.

See Also

[SilhouetteCoefficient\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

WithinBetweenRatio(TInstance) Class

Implements the within-between ratio (WB) internal evaluation method in [1] measuring the ratio of the sum-of-squares within cluster (SSW) and sum-of-squares between clusters (SSB). The result is multiplied by the negative of the number of clusters so that maximizing the ratio in some [ClusteringResult\(TInstance\)](#) provides the optimal partition, i.e., the optimal [ClusterSet\(TInstance\)](#).

Inheritance Hierarchy

[System.Object](#)

Aglomera.Evaluation.Internal.WithinBetweenRatio(TInstance)

Namespace: [Agglomera.Evaluation.Internal](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public class WithinBetweenRatio<TInstance> : IInternalEvaluationCriterion<TInstance>  
where TInstance : Object, IComparable<TInstance>
```

[View Source](#)


Type Parameters

TInstance


The type of instance considered.

The WithinBetweenRatio(TInstance) type exposes the following members.

Constructors







	Name	Description
	WithinBetweenRatio(TInstance)	Creates a new WithinBetweenRatio(TInstance) with given dissimilarity metric.

Properties

	Name	Description
	DissimilarityMetric	Gets the metric used by this criterion to measure the dissimilarity / distance between cluster elements.

Methods

	Name	Description
	Equals	(Inherited from Object .)

	Evaluate	Evaluates the given ClusterSet(TInstance) partition according to this evaluation criterion.
	Finalize	(Inherited from Object.)
	GetHashCode	(Inherited from Object.)
	GetType	(Inherited from Object.)
	MemberwiseClone	(Inherited from Object.)
	ToString	(Inherited from Object.)

Remarks

Notes: - In the original formulation in [1] the value was minimized, hence this implementation returns the negative WB ratio. References: [1] - [Zhao, Q., Xu, M., & Fränti, P. \(2009, April\). Sum-of-Squares Based Cluster Validity Index and Significance Analysis. In ICANNGA \(Vol. 5495, pp. 313-322\).](#)

See Also

[Agglomera.Evaluation.Internal Namespace](#)

WithinBetweenRatio(TInstance) Constructor

Creates a new [WithinBetweenRatio\(TInstance\)](#) with given dissimilarity metric.

Namespace: [Agglomera.Evaluation.Internal](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public WithinBetweenRatio(  
    IDissimilarityMetric<TInstance> dissimilarityMetric,  
    CentroidFunction<TInstance> centroidFunc  
)
```

[View Source](#)

Parameters

dissimilarityMetric

Type: [Agglomera.IDissimilarityMetric\(TInstance\)](#)

The metric used to calculate dissimilarity between cluster elements.

centroidFunc

Type: [Agglomera.CentroidFunction\(TInstance\)](#)

A function to get an element representing the centroid of a [Cluster\(TInstance\)](#).

See Also


[WithinBetweenRatio\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

WithinBetweenRatio(TInstance).WithinBetweenRatio(TInstance) Properties

The [WithinBetweenRatio\(TInstance\)](#) generic type exposes the following members.

Properties

	Name	Description
	DissimilarityMetric	Gets the metric used by this criterion to measure the dissimilarity / distance between cluster elements.

See Also

[WithinBetweenRatio\(TInstance\)Class](#)

[Aglomera.Evaluation.Internal Namespace](#)

WithinBetweenRatio(TInstance).DissimilarityMetric Property

Gets the metric used by this criterion to measure the dissimilarity / distance between cluster elements.

Namespace: [Agglomera.Evaluation.Internal](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
public IDissimilarityMetric<TInstance> DissimilarityMetric { get; }
```

[View Source](#)

Property Value

Type: [IDissimilarityMetric](#)(TInstance)

Implements

[IInternalEvaluationCriterion](#)(TInstance).DissimilarityMetric

See Also








[WithinBetweenRatio\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

WithinBetweenRatio(TInstance).WithinBetweenRatio(TInstance) Methods

The [WithinBetweenRatio\(TInstance\)](#) generic type exposes the following members.

Methods

	Name	Description
	Equals	(Inherited from Object .)
	Evaluate	Evaluates the given ClusterSet(TInstance) partition according to this evaluation criterion.
	Finalize	(Inherited from Object .)
	GetHashCode	(Inherited from Object .)
	GetType	(Inherited from Object .)
	MemberwiseClone	(Inherited from Object .)
	ToString	(Inherited from Object .)

See Also

[WithinBetweenRatio\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

WithinBetweenRatio(TInstance).Evaluate Method

Evaluates the given [ClusterSet\(TInstance\)](#) partition according to this evaluation criterion.

Namespace: [Agglomera.Evaluation.Internal](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public double Evaluate(  
    ClusterSet<TInstance> clusterSet  
)
```

[View Source](#)

Parameters

clusterSet

Type: [Agglomera.ClusterSet\(TInstance\)](#)

The clustering partition.

Return Value

Type: [Double](#)

The evaluation of the given partition according to this criterion.

Implements

[IInternalEvaluationCriterion\(TInstance\).Evaluate\(ClusterSet\(TInstance\)\)](#)

See Also

[WithinBetweenRatio\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

XieBeniIndex(TInstance) Class

Implements the internal evaluation method in [1] known as the Xie-Beni (XB) index. It defines the inter-cluster separation as the minimum square distance between cluster centers, and the intra-cluster compactness as the mean square distance between each data object and its cluster center.

Inheritance Hierarchy

[System.Object](#)

Aglomera.Evaluation.Internal.XieBeniIndex(TInstance)

Namespace: [Agglomera.Evaluation.Internal](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public class XieBeniIndex<TInstance> : IInternalEvaluationCriterion<TInstance>  
where TInstance : Object, IComparable<TInstance>
```

[View Source](#)


Type Parameters

TInstance


The type of instance considered.

The XieBeniIndex(TInstance) type exposes the following members.




Constructors





Name	Description
 XieBeniIndex(TInstance)	Creates a new XieBeniIndex(TInstance) with given dissimilarity metric.

Properties

Name	Description
 DissimilarityMetric	Gets the metric used by this criterion to measure the dissimilarity / distance between cluster elements.

Methods

Name	Description
 Equals	(Inherited from Object .)
 Evaluate	Evaluates the given ClusterSet(TInstance) partition according to this evaluation criterion.
 Finalize	(Inherited from Object .)

	GetHashCode	(Inherited from Object.)
	GetType	(Inherited from Object.)
	MemberwiseClone	(Inherited from Object.)
	ToString	(Inherited from Object.)

Remarks

Notes: - The formulation in [1] has a form of (Compactness) / (Separation) and therefore reaches the optimum clustering by being minimized. This implementation thus corresponds to - XB. References: [1] - [Xie, X. L., & Beni, G. \(1991\). A validity measure for fuzzy clustering. IEEE Transactions on pattern analysis and machine intelligence, 13\(8\), 841-847.](#)

See Also

[Agglomera.Evaluation.Internal Namespace](#)

XieBeniIndex(TInstance) Constructor

Creates a new [XieBeniIndex\(TInstance\)](#) with given dissimilarity metric.

Namespace: [Agglomera.Evaluation.Internal](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public XieBeniIndex(  
    IDissimilarityMetric<TInstance> dissimilarityMetric,  
    CentroidFunction<TInstance> centroidFunc  
)
```

[View Source](#)

Parameters

dissimilarityMetric

Type: [Agglomera.IDissimilarityMetric\(TInstance\)](#)

The metric used to calculate dissimilarity between cluster elements.

centroidFunc

Type: [Agglomera.CentroidFunction\(TInstance\)](#)

A function to get an element representing the centroid of a [Cluster\(TInstance\)](#).

See Also


[XieBeniIndex\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

XieBenilIndex(TInstance).XieBenilIndex(TInstance) Properties

The [XieBenilIndex\(TInstance\)](#) generic type exposes the following members.

Properties

	Name	Description
	DissimilarityMetric	Gets the metric used by this criterion to measure the dissimilarity / distance between cluster elements.

See Also

[XieBenilIndex\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

XieBeniIndex(TInstance).DissimilarityMetric Property

Gets the metric used by this criterion to measure the dissimilarity / distance between cluster elements.

Namespace: [Agglomera.Evaluation.Internal](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
public IDissimilarityMetric<TInstance> DissimilarityMetric { get; }
```

[View Source](#)

Property Value

Type: [IDissimilarityMetric](#)(TInstance)

Implements

[IInternalEvaluationCriterion](#)(TInstance).DissimilarityMetric

See Also








[XieBeniIndex\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

XieBeniIndex(TInstance).XieBeniIndex(TInstance) Methods

The [XieBeniIndex\(TInstance\)](#) generic type exposes the following members.

Methods

	Name	Description
	Equals	(Inherited from Object .)
	Evaluate	Evaluates the given ClusterSet(TInstance) partition according to this evaluation criterion.
	Finalize	(Inherited from Object .)
	GetHashCode	(Inherited from Object .)
	GetType	(Inherited from Object .)
	MemberwiseClone	(Inherited from Object .)
	ToString	(Inherited from Object .)

See Also

[XieBeniIndex\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

XieBeniIndex(TInstance).Evaluate Method

Evaluates the given [ClusterSet\(TInstance\)](#) partition according to this evaluation criterion.

Namespace: [Agglomera.Evaluation.Internal](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public double Evaluate(  
    ClusterSet<TInstance> clusterSet  
)
```

[View Source](#)

Parameters

clusterSet

Type: [Agglomera.ClusterSet\(TInstance\)](#)

The clustering partition.

Return Value

Type: [Double](#)

The evaluation of the given partition according to this criterion.

Implements

[IInternalEvaluationCriterion\(TInstance\).Evaluate\(ClusterSet\(TInstance\)\)](#)

See Also

[XieBeniIndex\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

XuIndex(TInstance) Class

Implements the Xu-index internal evaluation method proposed in [1] measuring the compactness of clusters given some partition scheme ([ClusterSet\(TInstance\)](#)). The higher the negative value of the Xu-index, the better the partition in some [ClusteringResult\(TInstance\)](#) is.

Inheritance Hierarchy

[System.Object](#)

Aglomera.Evaluation.Internal.XuIndex(TInstance)

Namespace: [Agglomera.Evaluation.Internal](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#
public class XuIndex<TInstance> : InternalEvaluationCriterion<TInstance>
where TInstance : Object, IComparable<TInstance>
```

[View Source](#)


Type Parameters

TInstance


The type of instance considered.

The XuIndex(TInstance) type exposes the following members.




Constructors





	Name	Description
	XuIndex(TInstance)	Creates a new XuIndex(TInstance) with given dissimilarity metric.

Properties

	Name	Description
	DissimilarityMetric	Gets the metric used by this criterion to measure the dissimilarity / distance between cluster elements.

Methods

	Name	Description
	Equals	(Inherited from Object .)
	Evaluate	Evaluates the given ClusterSet(TInstance) partition according to this evaluation criterion.
	Finalize	(Inherited from Object .)

	GetHashCode	(Inherited from Object.)
	GetType	(Inherited from Object.)
	MemberwiseClone	(Inherited from Object.)
	ToString	(Inherited from Object.)

Remarks

Notes: - In the original formulation in [1] the value was minimized, hence this implementation returns the negative Xu-index ratio. References: [1] - [Xu, L. \(1997\). Bayesian Ying–Yang machine, clustering and number of clusters. Pattern Recognition Letters, 18\(11\), 1167-1178.](#)

See Also

[Agglomera.Evaluation.Internal Namespace](#)

XuIndex(TInstance) Constructor

Creates a new [XuIndex\(TInstance\)](#) with given dissimilarity metric.

Namespace: [Agglomera.Evaluation.Internal](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public XuIndex(  
    IDissimilarityMetric<TInstance> dissimilarityMetric,  
    CentroidFunction<TInstance> centroidFunc  
)
```

[View Source](#)

Parameters

dissimilarityMetric

Type: [Agglomera.IDissimilarityMetric\(TInstance\)](#)

The metric used to calculate dissimilarity between cluster elements.

centroidFunc

Type: [Agglomera.CentroidFunction\(TInstance\)](#)

A function to get an element representing the centroid of a [Cluster\(TInstance\)](#).

See Also


[XuIndex\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

XuIndex(TInstance).XuIndex(TInstance) Properties

The [XuIndex\(TInstance\)](#) generic type exposes the following members.

Properties

	Name	Description
	DissimilarityMetric	Gets the metric used by this criterion to measure the dissimilarity / distance between cluster elements.

See Also

[XuIndex\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

XuIndex(TInstance).DissimilarityMetric Property

Gets the metric used by this criterion to measure the dissimilarity / distance between cluster elements.

Namespace: [Agglomera.Evaluation.Internal](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
public IDissimilarityMetric<TInstance> DissimilarityMetric { get; }
```

[View Source](#)

Property Value

Type: [IDissimilarityMetric](#)(TInstance)

Implements

[IInternalEvaluationCriterion](#)(TInstance).DissimilarityMetric

See Also








[XuIndex\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

XuIndex(TInstance).XuIndex(TInstance) Methods

The [XuIndex\(TInstance\)](#) generic type exposes the following members.

Methods

	Name	Description
	Equals	(Inherited from Object .)
	Evaluate	Evaluates the given ClusterSet(TInstance) partition according to this evaluation criterion.
	Finalize	(Inherited from Object .)
	GetHashCode	(Inherited from Object .)
	GetType	(Inherited from Object .)
	MemberwiseClone	(Inherited from Object .)
	ToString	(Inherited from Object .)

See Also

[XuIndex\(TInstance\)Class](#)

[Agglomera.Evaluation.Internal Namespace](#)

XuIndex(TInstance).Evaluate Method

Evaluates the given [ClusterSet\(TInstance\)](#) partition according to this evaluation criterion.

Namespace: [Agglomera.Evaluation.Internal](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public double Evaluate(  
    ClusterSet<TInstance> clusterSet  
)
```

[View Source](#)

Parameters

clusterSet

Type: [Agglomera.ClusterSet\(TInstance\)](#)

The clustering partition.

Return Value

Type: [Double](#)

The evaluation of the given partition according to this criterion.

Implements

[InternalEvaluationCriterion\(TInstance\).Evaluate\(ClusterSet\(TInstance\)\)](#)







See Also

[XuIndex\(TInstance\)Class](#)


[Agglomera.Evaluation.Internal Namespace](#)

Agglomera.Linkage Namespace

Classes

Class	Description
 AverageLinkage(TInstance)	Implements the unweighted pair-group average method or UPGMA, i.e., returns the mean distance between the elements in each cluster.
 CentroidLinkage(TInstance)	Implements the centroid linkage clustering method, i.e., returns the distance between the centroid for each cluster (a mean vector).
 CompleteLinkage(TInstance)	Implements the maximum or complete-linkage clustering method, i.e., returning the maximum value of all pairwise distances between the elements in each cluster. The method is also known as farthest neighbor clustering.
 MinimumEnergyLinkage(TInstance)	Implements the minimum (energy) E-distance method that minimizes a joint between-within measure of distance between clusters.
 SingleLinkage(TInstance)	Implements the minimum or single-linkage clustering method, i.e., returns the minimum value of all pairwise distances between the elements in each cluster. The method is also known as nearest neighbor clustering.
 WardsMinimumVarianceLinkage(TInstance)	Implements Ward's minimum variance method, i.e., returns the total within-cluster variance, corresponding to a weighted squared distance between cluster centers.

Interfaces

Interface	Description
 ILinkageCriterion(TInstance)	An interface for agglomeration (linkage) methods for computing distance between clusters to be used during agglomerative clustering.

AverageLinkage(TInstance) Class

Implements the unweighted pair-group average method or UPGMA, i.e., returns the mean distance between the elements in each cluster.

Inheritance Hierarchy

[System.Object](#)

Aglomera.Linkage.AverageLinkage(TInstance)

Namespace: [Agglomera.Linkage](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

C#

```
public class AverageLinkage<TInstance> : ILinkageCriterion<TInstance>
where TInstance : Object, IComparable<TInstance>
```

[View Source](#)


Type Parameters

TInstance


The type of instance considered.

The AverageLinkage(TInstance) type exposes the following members.




Constructors





	Name	Description
	AverageLinkage(TInstance)	Creates a new AverageLinkage(TInstance) with given dissimilarity metric.

Properties

	Name	Description
	DissimilarityMetric	Gets the metric used to measure the dissimilarity / distance between cluster elements according to this linkage criterion.

Methods

	Name	Description
	Calculate	Calculates the distance / dissimilarity between the two given clusters according to this linkage criterion.
	Equals	(Inherited from Object .)
	Finalize	(Inherited from Object .)

	GetHashCode	(Inherited from Object.)
	GetType	(Inherited from Object.)
	MemberwiseClone	(Inherited from Object.)
	ToString	(Inherited from Object.)

Remarks

Average linkage tries to strike a balance between [SingleLinkage\(TInstance\)](#) and [CompleteLinkage\(TInstance\)](#). It uses average pairwise dissimilarity, so clusters tend to be relatively compact and relatively far apart. However, it is not clear what properties the resulting clusters have when we cut an average linkage tree at given distance. Single and complete linkage trees each had simple interpretations [1]. References: [1] - <http://www.stat.cmu.edu/~ryantibs/datamining/lectures/05-clus2-marked.pdf>.

See Also

[Agglomera.Linkage Namespace](#)

AverageLinkage(TInstance) Constructor

Creates a new [AverageLinkage\(TInstance\)](#) with given dissimilarity metric.

Namespace: [Agglomera.Linkage](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public AverageLinkage(  
    IDissimilarityMetric<TInstance> metric  
)
```

[View Source](#)

Parameters

metric

Type: [Agglomera.IDissimilarityMetric\(TInstance\)](#)

The metric used to calculate dissimilarity between cluster elements.

See Also


[AverageLinkage\(TInstance\)Class](#)

[Agglomera.Linkage Namespace](#)

AverageLinkage(TInstance).AverageLinkage(TInstance) Properties

The [AverageLinkage\(TInstance\)](#) generic type exposes the following members.

Properties

	Name	Description
	DissimilarityMetric	Gets the metric used to measure the dissimilarity / distance between cluster elements according to this linkage criterion.

See Also

[AverageLinkage\(TInstance\)Class](#)

[Agglomera.Linkage Namespace](#)

AverageLinkage(TInstance).DissimilarityMetric Property

Gets the metric used to measure the dissimilarity / distance between cluster elements according to this linkage criterion.

Namespace: [Agglomera.Linkage](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
public IDissimilarityMetric<TInstance> DissimilarityMetric { get; }
```

[View Source](#)

Property Value

Type: [IDissimilarityMetric](#)(TInstance)

Implements

[ILinkageCriterion\(TInstance\).DissimilarityMetric](#)

See Also








[AverageLinkage\(TInstance\)Class](#)

[Agglomera.Linkage Namespace](#)

AverageLinkage(TInstance).AverageLinkage(TInstance) Methods

The [AverageLinkage\(TInstance\)](#) generic type exposes the following members.

Methods

	Name	Description
	Calculate	Calculates the distance / dissimilarity between the two given clusters according to this linkage criterion.
	Equals	(Inherited from Object .)
	Finalize	(Inherited from Object .)
	GetHashCode	(Inherited from Object .)
	GetType	(Inherited from Object .)
	MemberwiseClone	(Inherited from Object .)
	ToString	(Inherited from Object .)

See Also

[AverageLinkage\(TInstance\)Class](#)

[Agglomera.Linkage Namespace](#)

AverageLinkage(TInstance).Calculate Method

Calculates the distance / dissimilarity between the two given clusters according to this linkage criterion.

Namespace: [Agglomera.Linkage](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public double Calculate(  
    Cluster<TInstance> cluster1,  
    Cluster<TInstance> cluster2  
)
```

[View Source](#)

Parameters

cluster1

Type: [Agglomera.Cluster\(TInstance\)](#)

The first cluster.

cluster2

Type: [Agglomera.Cluster\(TInstance\)](#)

The second cluster.

Return Value

Type: [Double](#)

A value corresponding to the distance / dissimilarity between *cluster1* and *cluster2*, according to this linkage criterion.

Implements

[ILinkageCriterion\(TInstance\).Calculate\(Cluster\(TInstance\), Cluster\(TInstance\)\)](#)

See Also

[AverageLinkage\(TInstance\)Class](#)

[Agglomera.Linkage Namespace](#)

CentroidLinkage(TInstance) Class

Implements the centroid linkage clustering method, i.e., returns the distance between the centroid for each cluster (a mean vector).

Inheritance Hierarchy

[System.Object](#)

Aglomera.Linkage.CentroidLinkage(TInstance)

Namespace: [Agglomera.Linkage](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public class CentroidLinkage<TInstance> : ILinkageCriterion<TInstance>  
where TInstance : Object, IComparable<TInstance>
```

[View Source](#)


Type Parameters

TInstance


The type of instance considered.

The CentroidLinkage(TInstance) type exposes the following members.




Constructors





	Name	Description
	CentroidLinkage(TInstance)	Creates a new CentroidLinkage(TInstance) with given dissimilarity metric and centroid function.

Properties

	Name	Description
	DissimilarityMetric	Gets the metric used to measure the dissimilarity / distance between cluster elements according to this linkage criterion.

Methods

	Name	Description
	Calculate	Calculates the distance / dissimilarity between the two given clusters according to this linkage criterion.
	Equals	(Inherited from Object .)
	Finalize	(Inherited from Object .)

	GetHashCode	(Inherited from Object .)
	GetType	(Inherited from Object .)
	MemberwiseClone	(Inherited from Object .)
	ToString	(Inherited from Object .)

Remarks

Centroid linkage is equivalent to [AverageLinkage\(TInstance\)](#) of all pairs of documents from different clusters. Thus, the difference between average and centroid clustering is that the former considers all pairs of documents in computing average pairwise similarity, whereas centroid clustering excludes pairs from the same cluster [1]. References: [1] - <https://nlp.stanford.edu/IR-book/html/htmledition/centroid-clustering-1.html>.

See Also

[Agglomera.Linkage Namespace](#)

CentroidLinkage(TInstance) Constructor

Creates a new [CentroidLinkage\(TInstance\)](#) with given dissimilarity metric and centroid function.

Namespace: [Agglomera.Linkage](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public CentroidLinkage(  
    IDissimilarityMetric<TInstance> metric,  
    Func<Cluster<TInstance>, TInstance> centroidFunc  
)
```

[View Source](#)

Parameters

metric

Type: [Agglomera.IDissimilarityMetric\(TInstance\)](#)

The metric used to calculate dissimilarity between cluster elements.

centroidFunc

Type: [System.Func\(Cluster\(TInstance\), TInstance\)](#)

A function to get an element representing the centroid of a [Cluster\(TInstance\)](#).

See Also


[CentroidLinkage\(TInstance\)Class](#)

[Agglomera.Linkage Namespace](#)

CentroidLinkage(TInstance).CentroidLinkage(TInstance) Properties

The [CentroidLinkage\(TInstance\)](#) generic type exposes the following members.

Properties

	Name	Description
	DissimilarityMetric	Gets the metric used to measure the dissimilarity / distance between cluster elements according to this linkage criterion.

See Also

[CentroidLinkage\(TInstance\)Class](#)

[Agglomera.Linkage Namespace](#)

CentroidLinkage(TInstance).DissimilarityMetric Property

Gets the metric used to measure the dissimilarity / distance between cluster elements according to this linkage criterion.

Namespace: [Agglomera.Linkage](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
public IDissimilarityMetric<TInstance> DissimilarityMetric { get; }
```

[View Source](#)

Property Value

Type: [IDissimilarityMetric](#)(TInstance)

Implements

[ILinkageCriterion\(TInstance\).DissimilarityMetric](#)

See Also








[CentroidLinkage\(TInstance\)Class](#)

[Agglomera.Linkage Namespace](#)

CentroidLinkage(TInstance).CentroidLinkage(TInstance) Methods

The [CentroidLinkage\(TInstance\)](#) generic type exposes the following members.

Methods

	Name	Description
	Calculate	Calculates the distance / dissimilarity between the two given clusters according to this linkage criterion.
	Equals	(Inherited from Object .)
	Finalize	(Inherited from Object .)
	GetHashCode	(Inherited from Object .)
	GetType	(Inherited from Object .)
	MemberwiseClone	(Inherited from Object .)
	ToString	(Inherited from Object .)

See Also

[CentroidLinkage\(TInstance\)Class](#)

[Agglomera.Linkage Namespace](#)

CentroidLinkage(TInstance).Calculate Method

Calculates the distance / dissimilarity between the two given clusters according to this linkage criterion.

Namespace: [Agglomera.Linkage](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public double Calculate(  
    Cluster<TInstance> cluster1,  
    Cluster<TInstance> cluster2  
)
```

[View Source](#)

Parameters

cluster1

Type: [Agglomera.Cluster\(TInstance\)](#)

The first cluster.

cluster2

Type: [Agglomera.Cluster\(TInstance\)](#)

The second cluster.

Return Value

Type: [Double](#)

A value corresponding to the distance / dissimilarity between *cluster1* and *cluster2*, according to this linkage criterion.

Implements

[ILinkageCriterion\(TInstance\).Calculate\(Cluster\(TInstance\), Cluster\(TInstance\)\)](#)

See Also

[CentroidLinkage\(TInstance\)Class](#)

[Agglomera.Linkage Namespace](#)

CompleteLinkage(TInstance) Class

Implements the maximum or complete-linkage clustering method, i.e., returning the maximum value of all pairwise distances between the elements in each cluster. The method is also known as farthest neighbor clustering.

Inheritance Hierarchy

[System.Object](#)

Aglomera.Linkage.CompleteLinkage(TInstance)

Namespace: [Agglomera.Linkage](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public class CompleteLinkage<TInstance> : ILinkageCriterion<TInstance>  
where TInstance : Object, IComparable<TInstance>
```

[View Source](#)


Type Parameters

TInstance


The type of instance considered.

The CompleteLinkage(TInstance) type exposes the following members.



Constructors






	Name	Description
	CompleteLinkage(TInstance)	Creates a new CompleteLinkage(TInstance) with given dissimilarity metric.

Properties

	Name	Description
	DissimilarityMetric	Gets the metric used to measure the dissimilarity / distance between cluster elements according to this linkage criterion.

Methods

	Name	Description
	Calculate	Calculates the distance / dissimilarity between the two given clusters according to this linkage criterion.
	Equals	(Inherited from Object .)

	Finalize	(Inherited from Object.)
	GetHashCode	(Inherited from Object.)
	GetType	(Inherited from Object.)
	MemberwiseClone	(Inherited from Object.)
	ToString	(Inherited from Object.)

Remarks

Complete linkage clustering avoids a drawback of [SingleLinkage\(TInstance\)](#) - the so-called chaining phenomenon, where clusters formed via single linkage clustering may be forced together due to single elements being close to each other, even though many of the elements in each cluster may be very distant to each other. Complete linkage tends to find compact clusters of approximately equal diameter (https://en.wikipedia.org/wiki/Complete-linkage_clustering). However, complete-link clustering suffers from a different problem. It pays too much attention to outliers, points that do not fit well into the global structure of the cluster (<https://nlp.stanford.edu/IR-book/html/htmledition/single-link-and-complete-link-clustering-1.html>).

See Also

[Agglomera.Linkage Namespace](#)

CompleteLinkage(TInstance) Constructor

Creates a new [CompleteLinkage\(TInstance\)](#) with given dissimilarity metric.

Namespace: [Agglomera.Linkage](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public CompleteLinkage(  
    IDissimilarityMetric<TInstance> metric  
)
```

[View Source](#)

Parameters

metric

Type: [Agglomera.IDissimilarityMetric\(TInstance\)](#)

The metric used to calculate dissimilarity between cluster elements.

See Also


[CompleteLinkage\(TInstance\)Class](#)

[Agglomera.Linkage Namespace](#)

CompleteLinkage(TInstance).CompleteLinkage(TInstance) Properties

The [CompleteLinkage\(TInstance\)](#) generic type exposes the following members.

Properties

	Name	Description
	DissimilarityMetric	Gets the metric used to measure the dissimilarity / distance between cluster elements according to this linkage criterion.

See Also

[CompleteLinkage\(TInstance\)Class](#)

[Agglomera.Linkage Namespace](#)

CompleteLinkage(TInstance).DissimilarityMetric Property

Gets the metric used to measure the dissimilarity / distance between cluster elements according to this linkage criterion.

Namespace: [Agglomera.Linkage](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
public IDissimilarityMetric<TInstance> DissimilarityMetric { get; }
```

[View Source](#)

Property Value

Type: [IDissimilarityMetric](#)(TInstance)

Implements

[ILinkageCriterion\(TInstance\).DissimilarityMetric](#)

See Also








[CompleteLinkage\(TInstance\)Class](#)

[Agglomera.Linkage Namespace](#)

CompleteLinkage(TInstance).CompleteLinkage(TInstance) Methods

The [CompleteLinkage\(TInstance\)](#) generic type exposes the following members.

Methods

	Name	Description
	Calculate	Calculates the distance / dissimilarity between the two given clusters according to this linkage criterion.
	Equals	(Inherited from Object .)
	Finalize	(Inherited from Object .)
	GetHashCode	(Inherited from Object .)
	GetType	(Inherited from Object .)
	MemberwiseClone	(Inherited from Object .)
	ToString	(Inherited from Object .)

See Also

[CompleteLinkage\(TInstance\)Class](#)

[Agglomera.Linkage Namespace](#)

CompleteLinkage(TInstance).Calculate Method

Calculates the distance / dissimilarity between the two given clusters according to this linkage criterion.

Namespace: [Agglomera.Linkage](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public double Calculate(  
    Cluster<TInstance> cluster1,  
    Cluster<TInstance> cluster2  
)
```

[View Source](#)

Parameters

cluster1

Type: [Agglomera.Cluster\(TInstance\)](#)

The first cluster.

cluster2

Type: [Agglomera.Cluster\(TInstance\)](#)

The second cluster.

Return Value

Type: [Double](#)

A value corresponding to the distance / dissimilarity between *cluster1* and *cluster2*, according to this linkage criterion.

Implements

[ILinkageCriterion\(TInstance\).Calculate\(Cluster\(TInstance\), Cluster\(TInstance\)\)](#)

See Also

[CompleteLinkage\(TInstance\)Class](#)

[Agglomera.Linkage Namespace](#)

ILinkageCriterion(TInstance) Interface

An interface for agglomeration (linkage) methods for computing distance between clusters to be used during agglomerative clustering.

Namespace: [Agglomera.Linkage](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public interface ILinkageCriterion<TInstance>  
where TInstance : Object, IComparable<TInstance>
```

[View Source](#)


Type Parameters

TInstance


The type of instance considered.

The ILinkageCriterion(TInstance) type exposes the following members.

Properties

	Name	Description
	DissimilarityMetric	Gets the metric used to measure the dissimilarity / distance between cluster elements according to this linkage criterion.

Methods

	Name	Description
	Calculate	Calculates the distance / dissimilarity between the two given clusters according to this linkage criterion.


See Also

[Agglomera.Linkage Namespace](#)

ILinkageCriterion(TInstance).ILinkageCriterion(TInstance) Properties

The [ILinkageCriterion\(TInstance\)](#) generic type exposes the following members.

Properties

	Name	Description
	DissimilarityMetric	Gets the metric used to measure the dissimilarity / distance between cluster elements according to this linkage criterion.

See Also

[ILinkageCriterion\(TInstance\)Interface](#)

[Agglomera.Linkage Namespace](#)

ILinkageCriterion(TInstance).DissimilarityMetric Property

Gets the metric used to measure the dissimilarity / distance between cluster elements according to this linkage criterion.

Namespace: [Agglomera.Linkage](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

C#
IDissimilarityMetric<TInstance> DissimilarityMetric { get ; }

[View Source](#)

Property Value

Type: [IDissimilarityMetric](#)(TInstance)

See Also


[ILinkageCriterion\(TInstance\)Interface](#)

[Agglomera.Linkage Namespace](#)

ILinkageCriterion(TInstance).ILinkageCriterion(TInstance) Methods

The [ILinkageCriterion\(TInstance\)](#) generic type exposes the following members.

Methods

	Name	Description
	Calculate	Calculates the distance / dissimilarity between the two given clusters according to this linkage criterion.

See Also

[ILinkageCriterion\(TInstance\)Interface](#)

[Agglomera.Linkage Namespace](#)

ILinkageCriterion(TInstance).Calculate Method

Calculates the distance / dissimilarity between the two given clusters according to this linkage criterion.

Namespace: [Agglomera.Linkage](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#
double Calculate(
    Cluster<TInstance> cluster1,
    Cluster<TInstance> cluster2
)
```

[View Source](#)

Parameters

cluster1

Type: [Agglomera.Cluster\(TInstance\)](#)

The first cluster.

cluster2

Type: [Agglomera.Cluster\(TInstance\)](#)

The second cluster.

Return Value

Type: [Double](#)

A value corresponding to the distance / dissimilarity between *cluster1* and *cluster2*, according to this linkage criterion.

See Also

[ILinkageCriterion\(TInstance\)Interface](#)

[Agglomera.Linkage Namespace](#)

MinimumEnergyLinkage(TInstance) Class

Implements the minimum (energy) E-distance method that minimizes a joint between-within measure of distance between clusters.

Inheritance Hierarchy

[System.Object](#)

Aglomera.Linkage.MinimumEnergyLinkage(TInstance)

Namespace: [Agglomera.Linkage](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public class MinimumEnergyLinkage<TInstance> : ILinkageCriterion<TInstance>  
where TInstance : Object, IComparable<TInstance>
```

[View Source](#)


Type Parameters

TInstance



The type of instance considered.

The MinimumEnergyLinkage(TInstance) type exposes the following members.



Constructors






Name	Description
 MinimumEnergyLinkage(TInstance)	Creates a new MinimumEnergyLinkage(TInstance) with given dissimilarity metric.

Properties

Name	Description
 DissimilarityMetric	Gets the metric used to measure the dissimilarity / distance between cluster elements according to this linkage criterion.
 DistanceExponent	Gets or sets the distance exponent in the interval (0, 2].

Methods

Name	Description
 Calculate	Calculates the distance / dissimilarity between the two given clusters according to this linkage criterion.
 Equals	(Inherited from Object .)

 Finalize	(Inherited from Object .)
 GetHashCode	(Inherited from Object .)
 GetType	(Inherited from Object .)
 MemberwiseClone	(Inherited from Object .)
 ToString	(Inherited from Object .)

Remarks

"This method extends [WardsMinimumVarianceLinkage\(TInstance\)](#), by defining a cluster distance and objective function in terms of Euclidean distance, or any power of Euclidean distance in the interval (0, 2]. Ward's method is obtained as the special case when the power is 2. The ability of the proposed extension to identify clusters with nearly equal centers is an important advantage over geometric or cluster center methods" [1]. References: [1] - [Szekely, G. J., & Rizzo, M. L. \(2005\). Hierarchical clustering via joint between-within distances: Extending Ward's minimum variance method. Journal of classification, 22\(2\), 151-183](#)

See Also

[Agglomera.Linkage Namespace](#)

MinimumEnergyLinkage(TInstance) Constructor

Creates a new [MinimumEnergyLinkage\(TInstance\)](#) with given dissimilarity metric.

Namespace: [Agglomera.Linkage](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public MinimumEnergyLinkage(  
    IDissimilarityMetric<TInstance> metric  
)
```

[View Source](#)

Parameters

metric

Type: [Agglomera.IDissimilarityMetric\(TInstance\)](#)

The metric used to calculate dissimilarity between cluster elements.

See Also



[MinimumEnergyLinkage\(TInstance\)Class](#)

[Agglomera.Linkage Namespace](#)

MinimumEnergyLinkage(TInstance).MinimumEnergyLinkage(TInstance) Properties

The [MinimumEnergyLinkage\(TInstance\)](#) generic type exposes the following members.

Properties

	Name	Description
	DissimilarityMetric	Gets the metric used to measure the dissimilarity / distance between cluster elements according to this linkage criterion.
	DistanceExponent	Gets or sets the distance exponent in the interval (0, 2].

See Also

[MinimumEnergyLinkage\(TInstance\)Class](#)

[Agglomera.Linkage Namespace](#)

MinimumEnergyLinkage(TInstance).DissimilarityMetric Property

Gets the metric used to measure the dissimilarity / distance between cluster elements according to this linkage criterion.

Namespace: [Agglomera.Linkage](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
public IDissimilarityMetric<TInstance> DissimilarityMetric { get; }
```

[View Source](#)

Property Value

Type: [IDissimilarityMetric](#)(TInstance)

Implements

[ILinkageCriterion\(TInstance\).DissimilarityMetric](#)

See Also

[MinimumEnergyLinkage\(TInstance\)Class](#)

[Agglomera.Linkage Namespace](#)

MinimumEnergyLinkage(TInstance).DistanceExponent Property

Gets or sets the distance exponent in the interval (0, 2].

Namespace: [Agglomera.Linkage](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

C#

```
public double DistanceExponent { get; set; }
```

[View Source](#)

Property Value

Type: [Double](#)

See Also








[MinimumEnergyLinkage\(TInstance\)Class](#)

[Agglomera.Linkage Namespace](#)

MinimumEnergyLinkage(TInstance).MinimumEnergyLinkage(TInstance) Methods

The [MinimumEnergyLinkage\(TInstance\)](#) generic type exposes the following members.

Methods

	Name	Description
	Calculate	Calculates the distance / dissimilarity between the two given clusters according to this linkage criterion.
	Equals	(Inherited from Object .)
	Finalize	(Inherited from Object .)
	GetHashCode	(Inherited from Object .)
	GetType	(Inherited from Object .)
	MemberwiseClone	(Inherited from Object .)
	ToString	(Inherited from Object .)

See Also

[MinimumEnergyLinkage\(TInstance\)Class](#)

[Agglomera.Linkage Namespace](#)

MinimumEnergyLinkage(TInstance).Calculate Method

Calculates the distance / dissimilarity between the two given clusters according to this linkage criterion.

Namespace: [Aglomera.Linkage](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public double Calculate(  
    Cluster<TInstance> cluster1,  
    Cluster<TInstance> cluster2  
)
```

[View Source](#)

Parameters

cluster1

Type: [Aglomera.Cluster\(TInstance\)](#)

The first cluster.

cluster2

Type: [Aglomera.Cluster\(TInstance\)](#)

The second cluster.

Return Value

Type: [Double](#)

A value corresponding to the distance / dissimilarity between *cluster1* and *cluster2*, according to this linkage criterion.

Implements

[ILinkageCriterion\(TInstance\).Calculate\(Cluster\(TInstance\), Cluster\(TInstance\)\)](#)

See Also

[MinimumEnergyLinkage\(TInstance\)Class](#)

[Aglomera.Linkage Namespace](#)

SingleLinkage(TInstance) Class

Implements the minimum or single-linkage clustering method, i.e., returns the minimum value of all pairwise distances between the elements in each cluster. The method is also known as nearest neighbor clustering.

Inheritance Hierarchy

[System.Object](#)

Aglomera.Linkage.SingleLinkage(TInstance)

Namespace: [Agglomera.Linkage](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

C#

```
public class SingleLinkage<TInstance> : ILinkageCriterion<TInstance>
where TInstance : Object, IComparable<TInstance>
```

[View Source](#)


Type Parameters

TInstance


The type of instance considered.

The SingleLinkage(TInstance) type exposes the following members.



Constructors






	Name	Description
	SingleLinkage(TInstance)	Creates a new SingleLinkage(TInstance) with given dissimilarity metric.

Properties

	Name	Description
	DissimilarityMetric	Gets the metric used to measure the dissimilarity / distance between cluster elements according to this linkage criterion.

Methods

	Name	Description
	Calculate	Calculates the distance / dissimilarity between the two given clusters according to this linkage criterion.
	Equals	(Inherited from Object .)

 Finalize	(Inherited from Object .)
 GetHashCode	(Inherited from Object .)
 GetType	(Inherited from Object .)
 MemberwiseClone	(Inherited from Object .)
 ToString	(Inherited from Object .)

Remarks

A drawback of this method is that it tends to produce long thin clusters in which nearby elements of the same cluster have small distances, but elements at opposite ends of a cluster may be much farther from each other than two elements of other clusters [1]. Since the merge criterion is strictly local, a chain of points can be extended for long distances without regard to the overall shape of the emerging cluster. This effect is called chaining [2]. References: [1] - https://en.wikipedia.org/wiki/Single-linkage_clustering. [2] - <https://nlp.stanford.edu/IR-book/html/htmledition/single-link-and-complete-link-clustering-1.html>

See Also

[Agglomera.Linkage Namespace](#)

SingleLinkage(TInstance) Constructor

Creates a new [SingleLinkage\(TInstance\)](#) with given dissimilarity metric.

Namespace: [Agglomera.Linkage](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public SingleLinkage(  
    IDissimilarityMetric<TInstance> metric  
)
```

[View Source](#)

Parameters

metric

Type: [Agglomera.IDissimilarityMetric\(TInstance\)](#)

The metric used to calculate dissimilarity between cluster elements.

See Also


[SingleLinkage\(TInstance\)Class](#)

[Agglomera.Linkage Namespace](#)

SingleLinkage(TInstance).SingleLinkage(TInstance) Properties

The [SingleLinkage\(TInstance\)](#) generic type exposes the following members.

Properties

	Name	Description
	DissimilarityMetric	Gets the metric used to measure the dissimilarity / distance between cluster elements according to this linkage criterion.

See Also

[SingleLinkage\(TInstance\)Class](#)

[Agglomera.Linkage Namespace](#)

SingleLinkage(TInstance).DissimilarityMetric Property

Gets the metric used to measure the dissimilarity / distance between cluster elements according to this linkage criterion.

Namespace: [Agglomera.Linkage](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
public IDissimilarityMetric<TInstance> DissimilarityMetric { get; }
```

[View Source](#)

Property Value

Type: [IDissimilarityMetric](#)(TInstance)

Implements

[ILinkageCriterion\(TInstance\).DissimilarityMetric](#)

See Also








[SingleLinkage\(TInstance\)Class](#)

[Agglomera.Linkage Namespace](#)

SingleLinkage(TInstance).SingleLinkage(TInstance) Methods

The [SingleLinkage\(TInstance\)](#) generic type exposes the following members.

Methods

	Name	Description
	Calculate	Calculates the distance / dissimilarity between the two given clusters according to this linkage criterion.
	Equals	(Inherited from Object .)
	Finalize	(Inherited from Object .)
	GetHashCode	(Inherited from Object .)
	GetType	(Inherited from Object .)
	MemberwiseClone	(Inherited from Object .)
	ToString	(Inherited from Object .)

See Also

[SingleLinkage\(TInstance\)Class](#)

[Agglomera.Linkage Namespace](#)

SingleLinkage(TInstance).Calculate Method

Calculates the distance / dissimilarity between the two given clusters according to this linkage criterion.

Namespace: [Agglomera.Linkage](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public double Calculate(  
    Cluster<TInstance> cluster1,  
    Cluster<TInstance> cluster2  
)
```

[View Source](#)

Parameters

cluster1

Type: [Agglomera.Cluster\(TInstance\)](#)

The first cluster.

cluster2

Type: [Agglomera.Cluster\(TInstance\)](#)

The second cluster.

Return Value

Type: [Double](#)

A value corresponding to the distance / dissimilarity between *cluster1* and *cluster2*, according to this linkage criterion.

Implements

[ILinkageCriterion\(TInstance\).Calculate\(Cluster\(TInstance\), Cluster\(TInstance\)\)](#)

See Also

[SingleLinkage\(TInstance\)Class](#)

[Agglomera.Linkage Namespace](#)

WardsMinimumVarianceLinkage(TInstance) Class

Implements Ward's minimum variance method, i.e., returns the total within-cluster variance, corresponding to a weighted squared distance between cluster centers.

Inheritance Hierarchy

[System.Object](#)

Aglomera.Linkage.WardsMinimumVarianceLinkage(TInstance)

Namespace: [Agglomera.Linkage](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

C#

```
public class WardsMinimumVarianceLinkage<TInstance> : ILinkageCriterion<TInstance>
where TInstance : Object, IComparable<TInstance>
```

[View Source](#)


Type Parameters

TInstance


The type of instance considered.

The WardsMinimumVarianceLinkage(TInstance) type exposes the following members.



Constructors






Name	Description
 WardsMinimumVarianceLinkage(TInstance)	Creates a new WardsMinimumVarianceLinkage(TInstance) with given dissimilarity metric and centroid function.

Properties

Name	Description
 DissimilarityMetric	Gets the metric used to measure the dissimilarity / distance between cluster elements according to this linkage criterion.

Methods

Name	Description
 Calculate	Calculates the distance / dissimilarity between the two given clusters according to this linkage criterion.
 Equals	(Inherited from Object .)

 Finalize	(Inherited from Object .)
 GetHashCode	(Inherited from Object .)
 GetType	(Inherited from Object .)
 MemberwiseClone	(Inherited from Object .)
 ToString	(Inherited from Object .)

Remarks

"With hierarchical clustering, the sum of squares starts out at zero (because every point is in its own cluster) and then grows as we merge clusters. Ward's method keeps this growth as small as possible. This is nice if you believe that the sum of squares should be small. Notice that the number of points shows up in [the formula], as well as their geometric separation. Given two pairs of clusters whose centers are equally far apart, Ward's method will prefer to merge the smaller ones." [1] References: [1] - <http://www.stat.cmu.edu/~cshalizi/350/lectures/08/lecture-08.pdf>.

See Also

[Agglomera.Linkage Namespace](#)

WardsMinimumVarianceLinkage(TInstance) Constructor

Creates a new [WardsMinimumVarianceLinkage\(TInstance\)](#) with given dissimilarity metric and centroid function.

Namespace: [Agglomera.Linkage](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public WardsMinimumVarianceLinkage(  
    IDissimilarityMetric<TInstance> metric,  
    CentroidFunction<TInstance> centroidFunc  
)
```

[View Source](#)

Parameters

metric

Type: [Agglomera.IDissimilarityMetric\(TInstance\)](#)

The metric used to calculate dissimilarity between cluster elements.

centroidFunc

Type: [Agglomera.CentroidFunction\(TInstance\)](#)

A function to get an element representing the centroid of a [Cluster\(TInstance\)](#).

See Also


[WardsMinimumVarianceLinkage\(TInstance\)Class](#)

[Agglomera.Linkage Namespace](#)

WardsMinimumVarianceLinkage(TInstance).WardsMinimumVarianceLinkage(TInstance) Properties

The [WardsMinimumVarianceLinkage\(TInstance\)](#) generic type exposes the following members.

Properties

	Name	Description
	DissimilarityMetric	Gets the metric used to measure the dissimilarity / distance between cluster elements according to this linkage criterion.

See Also

[WardsMinimumVarianceLinkage\(TInstance\)Class](#)

[Agglomera.Linkage Namespace](#)

WardsMinimumVarianceLinkage(TInstance).DissimilarityMetric Property

Gets the metric used to measure the dissimilarity / distance between cluster elements according to this linkage criterion.

Namespace: [Agglomera.Linkage](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
public IDissimilarityMetric<TInstance> DissimilarityMetric { get; }
```

[View Source](#)

Property Value

Type: [IDissimilarityMetric](#)(TInstance)

Implements

[ILinkageCriterion](#)(TInstance).DissimilarityMetric

See Also








[WardsMinimumVarianceLinkage\(TInstance\)Class](#)

[Agglomera.Linkage Namespace](#)

WardsMinimumVarianceLinkage(TInstance).WardsMinimumVarianceLinkage(TInstance) Methods

The [WardsMinimumVarianceLinkage\(TInstance\)](#) generic type exposes the following members.

Methods

	Name	Description
	Calculate	Calculates the distance / dissimilarity between the two given clusters according to this linkage criterion.
	Equals	(Inherited from Object .)
	Finalize	(Inherited from Object .)
	GetHashCode	(Inherited from Object .)
	GetType	(Inherited from Object .)
	MemberwiseClone	(Inherited from Object .)
	ToString	(Inherited from Object .)

See Also

[WardsMinimumVarianceLinkage\(TInstance\)Class](#)

[Agglomera.Linkage Namespace](#)

WardsMinimumVarianceLinkage(TInstance).Calculate Method

Calculates the distance / dissimilarity between the two given clusters according to this linkage criterion.

Namespace: [Agglomera.Linkage](#)

Assembly: Aglomera (in Aglomera.dll) Version: 1.1.0

Syntax

```
C#  
  
public double Calculate(  
    Cluster<TInstance> cluster1,  
    Cluster<TInstance> cluster2  
)
```

[View Source](#)

Parameters

cluster1

Type: [Agglomera.Cluster](#)(TInstance)

The first cluster.

cluster2

Type: [Agglomera.Cluster](#)(TInstance)

The second cluster.

Return Value

Type: [Double](#)

A value corresponding to the distance / dissimilarity between *cluster1* and *cluster2*, according to this linkage criterion.

Implements

[ILinkageCriterion](#)(TInstance).Calculate(Cluster(TInstance), Cluster(TInstance))

See Also

[WardsMinimumVarianceLinkage\(TInstance\)Class](#)

[Agglomera.Linkage Namespace](#)