Comuna.NET

> A community analysis, tracking and graphing library for social networks written in C#

Comuna is a .NET open-source library written entirely in C# that implements the *Louvain method* for finding communities in large networks as described in [Blondel *et. al*, 2008]. The code corresponds to a C# adaptation of the C++ code in https://sites.google.com/site/findcommunities/. The main concept is that of *network modularity* that assesses the quality of the current community partition. The algorithm works by successively improving the network's modularity by trying to change the community that each node belongs to. If there is no improvement in modularity this means that the best community partition has been found.

Comuna.NET supports multiple updates to the underlying network connections (graph links), *i.e.*, it allows the analysis of the *evolution of communities* in a network. In addition, the results of community analysis can be exported to multiple formats. Specifically, Comuna.NET exports to image formats for the visualization of network structure and communities via Graphviz, and to json files that can be imported into Communities Viewer, an interactive web-application using D3.js.

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About

Comuna.NET is open-source under the MIT license and is free for commercial use.

- Source repository: https://github.com/pedrodbs/Comuna
- Issue tracker: https://github.com/pedrodbs/Comuna/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:

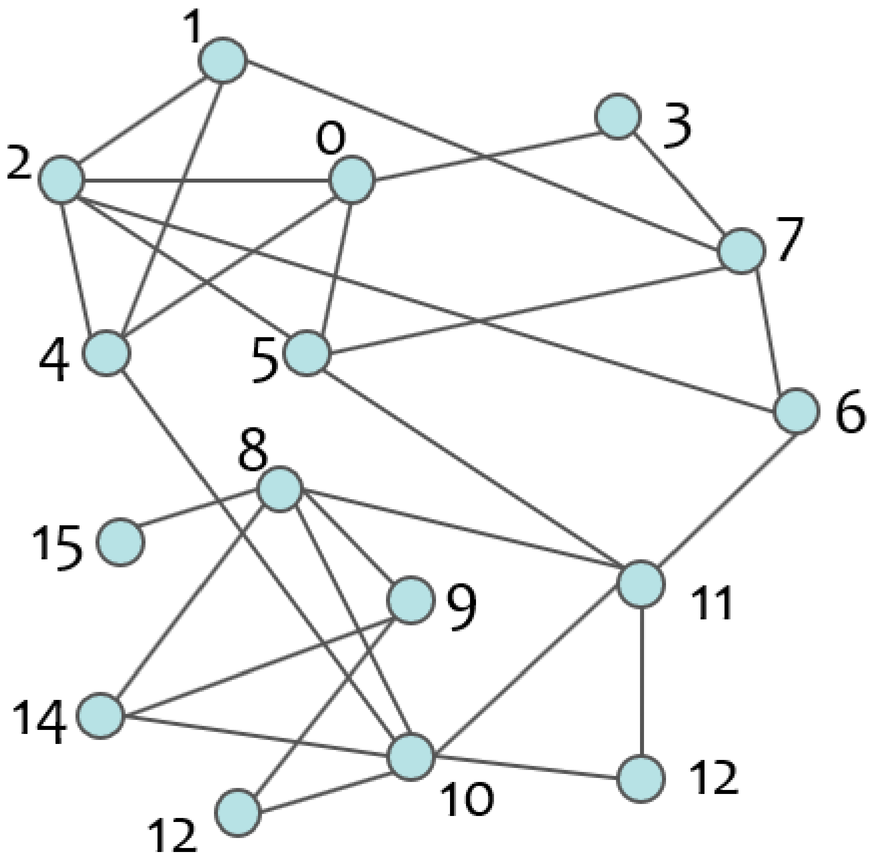
- **Comuna:** core package with the communities analyzer.
  - QuickGraph (forked to allow colored edges and vertexes when exporting to Graphviz dot format)
- **Comuna.D3:** package that includes the communities tracker algorithm and the methods to export them to Json files to be visualized with D3.js.
  - Json.NET v11.0.2
- **Comuna.Graphviz:** package to create undirected graph representations for the networks and communities and export them to image files via Graphviz.
  - QuickGraph (forked to allow colored edges and vertexes when exporting to Graphviz dot format)

Installation

You can `git clone` the Comuna.NET source code and use an IDE like VisualStudio to build the corresponding binaries.

Getting started

Consider the following *network* example from [Blondel *et. al*, 2008] represented as an undirected graph:



where each node can represent a different person and links can denote a connection or relationship between two individuals. In this example all connections have a weight of 1, but arbitrary weights can be provided denoting *e.g.*, different degrees of relationship.

We start by creating a `Network` object and adding all *nodes*. In Comuna.NET each node is represented by a different `uint` identifier:

```
var network = new Network();
for (var i = 0u; i < 16; i++)
    network.AddVertex(i);
```

We then define each `Connection` in the network by adding *edges* between the nodes:

```
network.AddEdge(new Connection(0, 2));
network.AddEdge(new Connection(0, 4));
network.AddEdge(new Connection(0, 3));
network.AddEdge(new Connection(0, 5));
network.AddEdge(new Connection(1, 2));
network.AddEdge(new Connection(1, 4));
network.AddEdge(new Connection(1, 7));
...
```

After having defined the network we can create the algorithm to analyze the communities:

```
var communityAlg = new CommunityAlgorithm(network, -1, 0);
```

where we define the *number of passes* of the algorithm (if -1, the algorithm computes as many passes as needed to increase the network's modularity) and the *minimum modularity gain*, corresponding to the criterion used to perform a new pass (if 0, even a minor increase is enough to perform one more pass).

We then update the algorithm to discover the communities in the network, *i.e.*, the best community partition:

```
communityAlg.Update();
```

A call to `DisplayCommunities` will then result in the following output:

```
Community: 0, Nodes: [8;9;10;12;14;15], In: 0, Tot: 20
Community: 1, Nodes: [1;4;2;0;5], In: 14, Tot: 20
Community: 2, Nodes: [11;13], In: -4, Tot: 7
Community: 3, Nodes: [3;7;6], In: 4, Tot: 9
```

By calling the `Update` function without arguments the nodes' communities are automatically renumbered, meaning that their identifying numbers (`uint`) are the lowest possible. If we don't want to renumber the communities we would call:

```
communityAlg.Update(false);
```

which would result in the following communities being formed:

```
Community: 1, Nodes: [1;4;2;0;5], In: 14, Tot: 20
Community: 3, Nodes: [3;7;6], In: 4, Tot: 9
Community: 9, Nodes: [9;14;12;8;15;10], In: 16, Tot: 20
Community: 11, Nodes: [11;13], In: 2, Tot: 7
```

Features

- **CSV import and export**
  - Allows the creation of a new `Network` by reading the edge information stored in a given CSV (comma-separated values) file. The format is simply 'source_node, target_node [, weight]'. If not provided, weight of the edge is considered to be 1. For example, the following code would load the network stored in `C:\network.csv` :

    ```
    network = Network.LoadFromCsv("C:\\network.csv");
    ```

  - Similarly, a network can be exported to a CSV file by calling:

    ```
    network.SaveToCsv("C:\\network=export.csv");
    ```

- **Communities tracking & D3.js export**
    - Let's now image that the network's connections are *changing throughout time* as a consequence of an external process, *e.g.*, that the relationships between the individuals in the network are developing, that new relationships are being formed or that existing relationships are ending.
    - In Comuna.NET, this corresponds to either adding or removing edges from the network, *e.g.*:

      ```
      network.AddEdge(new Connection(0, 1));      // adding a new connection
      network.RemoveEdge(new Connection(0, 2));   // removing an existing connection
      ```

      Note: to change the weight associated with a connection, we first remove the connection from the network and then add a new one with the new weight, *e.g.*:

      ```
      network.RemoveEdge(new Connection(0, 2));   // removing an existing connection
      network.AddEdge(new Connection(0, 2, 0.5)); // changing the weight
      ```

    - By using the *Comuna.D3* package we can track the changes in the network's connections and the consequent changes in the nodes' communities at each time step and later visualize them using the Communities Viewer web-application. To create the tracker we simply call:

      ```
      using Comuna.D3
      ...
      var tracker = new CommunityTracker(communityAlg, pathToD3File, maxUpdates)
      ```

      where `pathToD3File` is the path to the *Json* file where the network, its connections and the nodes' communities are written after the update at each time step. `maxUpdates` is the *maximum number of updates* that are going to be performed to the network's connections. **Note:** the tracker initially creates the Json file and at each update it appends the information regarding changes in the network structure (addition and removal of nodes) and in the nodes' communities.
    - At each time step, after updating the network's connections we also update the community algorithm and the tracker, *e.g.*:

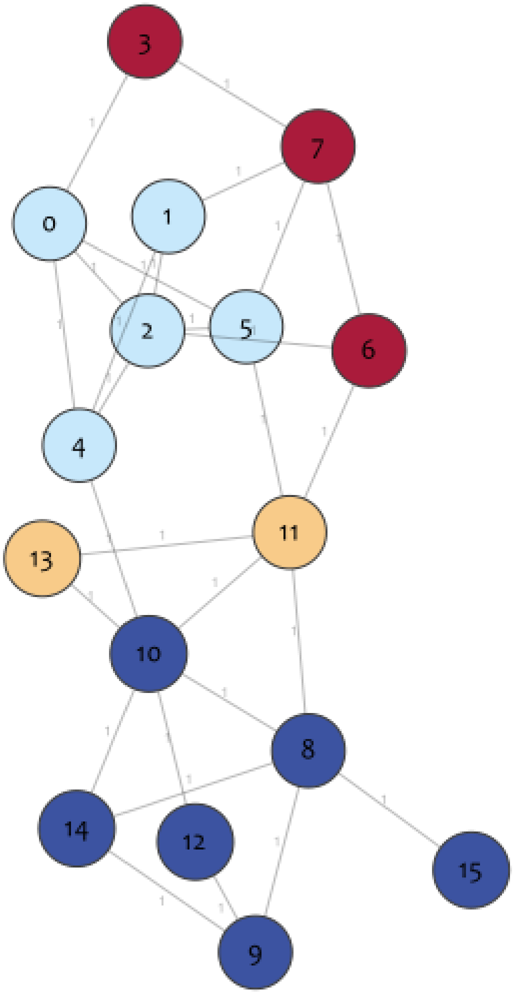
      ```
      for(var i=0; i<100; i++)
      {
          // update connections to network
          ...
          communityAlg.Update();
          tracker.Update();
      }
      tracker.Dispose()
      ```

      where we can call `tracker.Dispose()` to release the lock to the Json file being updated.
    - When loaded in Communities Viewer, the first time step would produce the following community graph:
- **Graphviz export**

- Export a program's tree representation to image file with Graphviz (requires Graphviz installed and *dot* binary accessible from the system's path), *e.g.*:

  ```
  using Comuna.Graphviz;
  using QuickGraph.Graphviz.Dot;
  ...
  var filePath = communityAlg.ToGraphvizFile(
      Path.GetFullPath("."), "communities-graphviz.png", true, GraphvizImageType.Png);
  ```

  would produce the following image:



Examples

Example code can be found in the src/Examples folder in the repository. Several open-source social networks adapted to work with the example applications can be found in src/Examples/networks.

- **CommunitiesEvolution:** a simple example of the evolution of a social network involving tracking the addition and removal of connections. The results are saved to a Json file for later visualization.
- **CommunitiesGenerator:** a Windows.Forms application to generate random network connections between a given number of nodes and also a random number of update time-steps. The final network structure and nodes' communities is displayed and the corresponding Json file is saved.
- **CommunitiesVisualizer:** a Windows.Forms application that allows loading a network from a CSV file for the visualization of the communities therein. The community algorithm can be parameterized and

the result can be exported to an image file.

See Also

References

1. Blondel, V. D., Guillaume, J. L., Lambiotte, R., & Lefebvre, E. (2008). Fast unfolding of communities in large networks. *Journal of statistical mechanics: theory and experiment*, *2008*(10), Bristol: IOP Publishing Ltd.

Other links

- Louvain method: Finding communities in large networks
- Communities Viewer
- D3.js

Comuna Namespace

Classes

	Class	Description
	CommunityAlgorithm	Implements the "Louvain method" for finding communities in large networks as described in [1]. The code corresponds to a c# adaptation of the c++ code in https://sites.google.com/site/findcommunities/. A feature was added so that multiple updates to the underlying network connections (graph links) is supported, i.e., it allows the analysis of the evolution of communities in a network.
	Connection	Represents an undirected connection in an Network with an associated weight.
	Network	Represents a network structure with a series of Connection between nodes, where each node has a distinct UInt32 identifier.

CommunityAlgorithm Class

Implements the "Louvain method" for finding communities in large networks as described in [1]. The code corresponds to a c# adaptation of the c++ code in https://sites.google.com/site/findcommunities/. A feature was added so that multiple updates to the underlying network connections (graph links) is supported, i.e., it allows the analysis of the evolution of communities in a network.

Inheritance Hierarchy

System.Object
  Comuna.CommunityAlgorithm

Namespace: Comuna
Assembly: Comuna (in Comuna.dll) Version: 1.0.0

Syntax

C#

```
public class CommunityAlgorithm : IDisposable
```

View Source

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

Constructors

	Name	Description
	CommunityAlgorithm	Creates a new **CommunityAlgorithm** according to the provided graph.

Properties

	Name	Description
	Communities	Gets the set of nodes belonging to each community.
	MinModularity	Gets the minimal modularity difference between passes. If 0, even a minor increase is enough to perform one more pass.
	Network	Gets the network graph used to compute communities.
	NodesCommunities	Gets the community of each node.
	NumPasses	Gets the number of passes for one level computation. If -1, the algorithm computes as many passes as needed to increase modularity.
	Size	Gets the number of nodes in the network and size of all vectors.

Methods

	Name	Description
	DisplayCommunities	Displays the nodes belonging to each community.
	DisplayCommunityGraph	Displays the graph of the existing communities, i.e., without the nodes.
	DisplayNodesCommunities	Displays the community that each node in the network belongs to.
	DisplayPartition	Displays the current partition (with communities renumbered from 0 to k-1).
	Dispose	Releases all resources used by the **CommunityAlgorithm**
	Equals	(Inherited from Object.)
	Finalize	(Inherited from Object.)
	GetCommunityNetwork	Generates a Network of the existing communities, i.e., without the nodes.
	GetHashCode	(Inherited from Object.)
	GetModularity	Gets the modularity of the current community partition.
	GetNumberCommunities	Gets the number of active communities, i.e., the communities with one or more elements belonging to it.
	GetType	(Inherited from Object.)
	LoadFromFile	Initializes the community partition with the information stored in the given file.
	MemberwiseClone	(Inherited from Object.)
	RenumberCommunities	Renumbers each community according to the total number of communities (larger first) and by changing their ID to the lowest one possible. Tries to keep communities IDs if possible to avoid renumbering.
	ToString	(Inherited from Object.)
	Update	Computes communities in the graph iteratively until there are changes in any node's community or the changes in modularity are large enough.

Extension Methods

	Name	Description
	ToD3GraphFile	Saves the network of the given **CommunityAlgorithm** to a d3.js graph file. (Defined by D3Extensions.)
	ToGraphvizFile	Saves the given Network to an image file. (Defined by Extensions.)

Remarks

[1] - Blondel, V. D., Guillaume, J. L., Lambiotte, R., & Lefebvre, E. (2008). Fast unfolding of communities in large networks. Journal of statistical mechanics: theory and experiment, 2008(10), Bristol: IOP Publishing Ltd.

See Also

Comuna Namespace

CommunityAlgorithm Constructor

Creates a new CommunityAlgorithm according to the provided graph.

Namespace: Comuna
Assembly: Comuna (in Comuna.dll) Version: 1.0.0

Syntax

C#

```
public CommunityAlgorithm(
	Network network,
	int numPasses = -1,
	double minModularity = 1E-06
)
```

View Source

Parameters

network
Type: Comuna.Network
The network graph to extract communities from.

numPasses (Optional)
Type: System.Int32
The number of passes for one level computation. If -1, the algorithm computes as many passes as needed to increase modularity.

minModularity (Optional)
Type: System.Double
The criterion used to perform a new pass. If 0, even a minor increase is enough to perform one more pass.

See Also

CommunityAlgorithm Class
Comuna Namespace

CommunityAlgorithm.CommunityAlgorithm Properties

The CommunityAlgorithm type exposes the following members.

Properties

	Name	Description
	Communities	Gets the set of nodes belonging to each community.
	MinModularity	Gets the minimal modularity difference between passes. If 0, even a minor increase is enough to perform one more pass.
	Network	Gets the network graph used to compute communities.
	NodesCommunities	Gets the community of each node.
	NumPasses	Gets the number of passes for one level computation. If -1, the algorithm computes as many passes as needed to increase modularity.
	Size	Gets the number of nodes in the network and size of all vectors.

See Also

CommunityAlgorithm Class
Comuna Namespace

CommunityAlgorithm.Communities Property

Gets the set of nodes belonging to each community.

Namespace: Comuna
Assembly: Comuna (in Comuna.dll) Version: 1.0.0

Syntax

C#

```
public HashSet<uint>[] Communities { get; }
```

View Source

Property Value

Type: HashSet(UInt32)[]

See Also

CommunityAlgorithm Class
Comuna Namespace

CommunityAlgorithm.MinModularity Property

Gets the minimal modularity difference between passes. If 0, even a minor increase is enough to perform one more pass.

Namespace: Comuna
Assembly: Comuna (in Comuna.dll) Version: 1.0.0

Syntax

C#
public double MinModularity { get; }

View Source

Property Value

Type: Double

See Also

CommunityAlgorithm Class
Comuna Namespace

CommunityAlgorithm.Network Property

Gets the network graph used to compute communities.

Namespace: Comuna
Assembly: Comuna (in Comuna.dll) Version: 1.0.0

Syntax

C#

```
public Network Network { get; }
```

View Source

Property Value

Type: Network

See Also

CommunityAlgorithm Class
Comuna Namespace

CommunityAlgorithm.NodesCommunities Property

Gets the community of each node.

Namespace: Comuna
Assembly: Comuna (in Comuna.dll) Version: 1.0.0

Syntax

C#

```
public uint[] NodesCommunities { get; }
```

View Source

Property Value

Type: UInt32[]

See Also

CommunityAlgorithm Class
Comuna Namespace

CommunityAlgorithm.NumPasses Property

Gets the number of passes for one level computation. If -1, the algorithm computes as many passes as needed to increase modularity.

Namespace: Comuna
Assembly: Comuna (in Comuna.dll) Version: 1.0.0

Syntax

C#

```
public int NumPasses { get; }
```

View Source

Property Value

Type: Int32

See Also

CommunityAlgorithm Class
Comuna Namespace

CommunityAlgorithm.Size Property

Gets the number of nodes in the network and size of all vectors.

Namespace: Comuna
Assembly: Comuna (in Comuna.dll) Version: 1.0.0

Syntax

C#

```
public int Size { get; }
```

View Source

Property Value

Type: Int32

See Also

CommunityAlgorithm Class
Comuna Namespace

CommunityAlgorithm.CommunityAlgorithm Methods

The CommunityAlgorithm type exposes the following members.

Methods

	Name	Description
	DisplayCommunities	Displays the nodes belonging to each community.
	DisplayCommunityGraph	Displays the graph of the existing communities, i.e., without the nodes.
	DisplayNodesCommunities	Displays the community that each node in the network belongs to.
	DisplayPartition	Displays the current partition (with communities renumbered from 0 to k-1).
	Dispose	
	Equals	(Inherited from Object.)
	Finalize	(Inherited from Object.)
	GetCommunityNetwork	Generates a Network of the existing communities, i.e., without the nodes.
	GetHashCode	(Inherited from Object.)
	GetModularity	Gets the modularity of the current community partition.
	GetNumberCommunities	Gets the number of active communities, i.e., the communities with one or more elements belonging to it.
	GetType	(Inherited from Object.)
	LoadFromFile	Initializes the community partition with the information stored in the given file.
	MemberwiseClone	(Inherited from Object.)
	RenumberCommunities	Renumbers each community according to the total number of communities (larger first) and by changing their ID to the lowest one possible. Tries to keep communities IDs if possible to avoid renumbering.
	ToString	(Inherited from Object.)
	Update	Computes communities in the graph iteratively until there are changes in any node's community or the changes in modularity are large enough.

Extension Methods

	Name	Description
	ToD3GraphFile	Saves the network of the given CommunityAlgorithm to a d3.js graph file. (Defined by D3Extensions.)
	ToGraphvizFile	Saves the given Network to an image file. (Defined by Extensions.)

See Also

[CommunityAlgorithm Class]

[Comuna Namespace]

CommunityAlgorithm.DisplayCommunities Method

Displays the nodes belonging to each community.

Namespace: Comuna
Assembly: Comuna (in Comuna.dll) Version: 1.0.0

Syntax

C#

```
public void DisplayCommunities()
```

View Source

See Also

CommunityAlgorithm Class
Comuna Namespace

CommunityAlgorithm.DisplayCommunityGraph Method

Displays the graph of the existing communities, i.e., without the nodes.

Namespace: Comuna
Assembly: Comuna (in Comuna.dll) Version: 1.0.0

Syntax

C#

```
public void DisplayCommunityGraph()
```

View Source

See Also

CommunityAlgorithm Class
Comuna Namespace

CommunityAlgorithm.DisplayNodesCommunities Method

Displays the community that each node in the network belongs to.

Namespace: Comuna
Assembly: Comuna (in Comuna.dll) Version: 1.0.0

Syntax

C#
public void DisplayNodesCommunities()

View Source

See Also

CommunityAlgorithm Class
Comuna Namespace

CommunityAlgorithm.DisplayPartition Method

Displays the current partition (with communities renumbered from 0 to k-1).

Namespace: Comuna
Assembly: Comuna (in Comuna.dll) Version: 1.0.0

Syntax

C#

```
public void DisplayPartition()
```

View Source

See Also

CommunityAlgorithm Class
Comuna Namespace

CommunityAlgorithm.Dispose Method

Releases all resources used by the CommunityAlgorithm

Namespace: Comuna
Assembly: Comuna (in Comuna.dll) Version: 1.0.0

Syntax

C#

```
public void Dispose()
```

View Source

Implements
IDisposable.Dispose()

See Also

CommunityAlgorithm Class
Comuna Namespace

CommunityAlgorithm.GetCommunityNetwork Method

Generates a Network of the existing communities, i.e., without the nodes.

Namespace: Comuna
Assembly: Comuna (in Comuna.dll) Version: 1.0.0

Syntax

C#

```
public Network GetCommunityNetwork()
```

View Source

Return Value

Type: Network
The network graph of communities.

See Also

CommunityAlgorithm Class
Comuna Namespace

CommunityAlgorithm.GetModularity Method

Gets the modularity of the current community partition.

Namespace: Comuna
Assembly: Comuna (in Comuna.dll) Version: 1.0.0

Syntax

C#

```
public double GetModularity()
```

View Source

Return Value

Type: Double
The modularity of the current community partition.

See Also

CommunityAlgorithm Class
Comuna Namespace

CommunityAlgorithm.GetNumberCommunities Method

Gets the number of active communities, i.e., the communities with one or more elements belonging to it.

Namespace: Comuna
Assembly: Comuna (in Comuna.dll) Version: 1.0.0

Syntax

C#

```
public int GetNumberCommunities()
```

View Source

Return Value

Type: Int32
The number of active communities.

See Also

CommunityAlgorithm Class
Comuna Namespace

CommunityAlgorithm.LoadFromFile Method

Initializes the community partition with the information stored in the given file.

Namespace: Comuna
Assembly: Comuna (in Comuna.dll) Version: 1.0.0

Syntax

C#

```
public void LoadFromFile(
	string fileName
)
```

View Source

Parameters

fileName
Type: System.String
The path to the file containing the partition information.

See Also

CommunityAlgorithm Class
Comuna Namespace

CommunityAlgorithm.RenumberCommunities Method

Renumbers each community according to the total number of communities (larger first) and by changing their ID to the lowest one possible. Tries to keep communities IDs if possible to avoid renumbering.

Namespace: Comuna
Assembly: Comuna (in Comuna.dll) Version: 1.0.0

Syntax

C#

```
public void RenumberCommunities()
```

View Source

See Also

CommunityAlgorithm Class
Comuna Namespace

CommunityAlgorithm.Update Method

Computes communities in the graph iteratively until there are changes in any node's community or the changes in modularity are large enough.

Namespace: Comuna
Assembly: Comuna (in Comuna.dll) Version: 1.0.0

Syntax

C#

```
public bool Update(
	bool renumberCommunities = true
)
```

View Source

Parameters

renumberCommunities (Optional)
Type: System.Boolean
Whether to renumber communities after the update by calling RenumberCommunities().

Return Value

Type: Boolean
true, if some node changed community, false otherwise.

See Also

CommunityAlgorithm Class
Comuna Namespace

Connection Class

Represents an undirected connection in an Network with an associated weight.

Inheritance Hierarchy

System.Object
  Comuna.Connection

Namespace: Comuna
Assembly: Comuna (in Comuna.dll) Version: 1.0.0

Syntax

C#

```
public class Connection : IUndirectedEdge<uint>,
	IEdge<uint>, IEquatable<Connection>
```

View Source

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

Constructors

	Name	Description
	Connection	Creates a new **Connection** linking the given source and target with the associated weight.

Properties

	Name	Description
	Source	Gets the source node.
	Target	Gets the target node.
	Weight	Gets the weight associated with this connection.

Methods

	Name	Description
	Equals(Object)	(Overrides Object.Equals(Object).)
	Equals(Connection)	Tests whether this connection is equal to another one.
	Finalize	(Inherited from Object.)
	GetHashCode	(Overrides Object.GetHashCode().)
	GetType	(Inherited from Object.)
	MemberwiseClone	(Inherited from Object.)
	ToString	(Overrides Object.ToString().)

Operators

	Name	Description
S	Equality	Tests whether the two connections are equal.
S	Inequality	Tests whether the two connections are different (not equal).

See Also

Comuna Namespace

Connection Constructor

Creates a new Connection linking the given source and target with the associated weight.

Namespace: Comuna
Assembly: Comuna (in Comuna.dll) Version: 1.0.0

Syntax

C#

```
public Connection(
	uint source,
	uint target,
	double weight = 1
)
```

View Source

Parameters

source
Type: System.UInt32
The source of the connection.

target
Type: System.UInt32
The target of the connection.

weight (Optional)
Type: System.Double
The weight associated with the connection.

See Also

Connection Class
Comuna Namespace

Connection.Connection Properties

The Connection type exposes the following members.

Properties

	Name	Description
	Source	Gets the source node.
	Target	Gets the target node.
	Weight	Gets the weight associated with this connection.

See Also

Connection Class

Comuna Namespace

Connection.Source Property

Gets the source node.

Namespace: Comuna
Assembly: Comuna (in Comuna.dll) Version: 1.0.0

Syntax

C#

```
public uint Source { get; }
```

View Source

Property Value

Type: UInt32

Implements

IEdge.Source

See Also

Connection Class
Comuna Namespace

Connection.Target Property

Gets the target node.

Namespace: Comuna
Assembly: Comuna (in Comuna.dll) Version: 1.0.0

Syntax

C#

```
public uint Target { get; }
```

View Source

Property Value

Type: UInt32

Implements

IEdge.Target

See Also

Connection Class
Comuna Namespace

Connection.Weight Property

Gets the weight associated with this connection.

Namespace: Comuna
Assembly: Comuna (in Comuna.dll) Version: 1.0.0

Syntax

C#

```
public double Weight { get; }
```

View Source

Property Value

Type: Double

See Also

Connection Class
Comuna Namespace

Connection.Connection Methods

The Connection type exposes the following members.

Methods

	Name	Description
	Equals(Object)	(Overrides Object.Equals(Object).)
	Equals(Connection)	Tests whether this connection is equal to another one.
	Finalize	(Inherited from Object.)
	GetHashCode	(Overrides Object.GetHashCode().)
	GetType	(Inherited from Object.)
	MemberwiseClone	(Inherited from Object.)
	ToString	(Overrides Object.ToString().)

See Also

Connection Class

Comuna Namespace

Connection.Equals Method

Overload List

	Name	Description
◆	Equals(Object)	(Overrides Object.Equals(Object).)
◆	Equals(Connection)	Tests whether this connection is equal to another one.

See Also

Connection Class

Comuna Namespace

Connection.Equals Method (Object)

Namespace: Comuna
Assembly: Comuna (in Comuna.dll) Version: 1.0.0

Syntax

C#

```
public override bool Equals(
	Object obj
)
```

View Source

Parameters

obj

Type: System.Object

Return Value

Type: Boolean

See Also

Connection Class
Equals Overload
Comuna Namespace

Connection.Equals Method (Connection)

Tests whether this connection is equal to another one.

Namespace: Comuna
Assembly: Comuna (in Comuna.dll) Version: 1.0.0

Syntax

C#

```
public bool Equals(
	Connection other
)
```

View Source

Parameters

other
Type: Comuna.Connection
The other connection.

Return Value

Type: Boolean
A Boolean indicating whether this connection is equal to the other one.

Implements

IEquatable(T).Equals(T)

See Also

Connection Class
Equals Overload
Comuna Namespace

Connection.GetHashCode Method

Namespace: Comuna
Assembly: Comuna (in Comuna.dll) Version: 1.0.0

Syntax

C#

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

View Source

Return Value

Type: Int32

See Also

Connection Class
Comuna Namespace

Connection.ToString Method

Namespace: Comuna
Assembly: Comuna (in Comuna.dll) Version: 1.0.0

Syntax

C#
public override string ToString()

View Source

Return Value

Type: String

See Also

Connection Class
Comuna Namespace

Connection.Connection Operators

The Connection type exposes the following members.

Operators

	Name	Description
S	Equality	Tests whether the two connections are equal.
S	Inequality	Tests whether the two connections are different (not equal).

See Also

Connection Class

Comuna Namespace

Connection.Equality Operator

Tests whether the two connections are equal.

Namespace: Comuna
Assembly: Comuna (in Comuna.dll) Version: 1.0.0

Syntax

C#

```
public static bool operator ==(
            Connection left,
            Connection right
)
```

View Source

Parameters

left
Type: Comuna.Connection
The first connection.

right
Type: Comuna.Connection
The second connection.

Return Value

Type: Boolean
A Boolean indicating whether the two connections are equal.

See Also

Connection Class
Comuna Namespace

Connection.Inequality Operator

Tests whether the two connections are different (not equal).

Namespace: Comuna
Assembly: Comuna (in Comuna.dll) Version: 1.0.0

Syntax

C#

```
public static bool operator !=(
            Connection left,
            Connection right
)
```

View Source

Parameters

left
Type: Comuna.Connection
The first connection.

right
Type: Comuna.Connection
The second connection.

Return Value

Type: Boolean
A Boolean indicating whether the two connections are different.

See Also

Connection Class
Comuna Namespace

Network Class

Represents a network structure with a series of Connection between nodes, where each node has a distinct UInt32 identifier.

Inheritance Hierarchy

System.Object
UndirectedGraph(UInt32, Connection)
Comuna.Network

Namespace: Comuna
Assembly: Comuna (in Comuna.dll) Version: 1.0.0

Syntax

C#

```
public class Network : UndirectedGraph<uint, Connection>,
          IDisposable
```

View Source

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

Constructors

	Name	Description
	Network	Initializes a new instance of the **Network** class

Properties

	Name	Description
	AllowParallelEdges	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	EdgeCapacity	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	EdgeCount	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	EdgeEqualityComparer	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	Edges	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	IsDirected	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	IsEdgesEmpty	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	IsVerticesEmpty	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	TotalWeight	Gets the total weight associated with all connections in this network.
	VertexCount	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	Vertices	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	Weights	Gets the weights associated with each node in this network.

Methods

	Name	Description
	AddEdge	Adds a new Connection to the network.
	AddEdgeRange	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	AddVertex	Adds a new node to the network.
	AddVertexRange	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	AddVerticesAndEdge	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	AddVerticesAndEdgeRange	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	AdjacentDegree	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	AdjacentEdge	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	AdjacentEdges	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	Clear	Removes all nodes and connections from this network.
	ClearAdjacentEdges	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	ClearConnections	Removes all connections from this network.
	ClearNodes	Removes all nodes from this network.
	ContainsEdge(UTP)	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	ContainsEdge(UTP, UTP)	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	ContainsVertex	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	Dispose	Releases all resources used by the **Network**
	Equals	(Inherited from Object.)
	Finalize	(Inherited from Object.)
	GetHashCode	(Inherited from Object.)
	GetType	(Inherited from Object.)
	IsAdjacentEdgesEmpty	(Inherited from **UndirectedGraph**(UInt32, Connection).)
S	LoadFromCsv	Creates a new **Network** by reading the edge information stored in the given CSV (comma-separated values) file. The format is 'source_node, target_node [, weight]'. If not provided, weight of the edge is considered to be 1.
	MemberwiseClone	(Inherited from Object.)
	OnEdgeAdded	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	OnEdgeRemoved	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	OnVertexAdded	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	OnVertexRemoved	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	RemoveAdjacentEdgeIf	(Inherited from **UndirectedGraph**(UInt32, Connection).)

	RemoveEdge	Removes the given Connection from the network and updates weights.
	RemoveEdgeIf	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	RemoveEdges	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	RemoveVertex	Removes the given node (ID) from the network and updates weights.
	RemoveVertexIf	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	SaveToCsv	Writes the network's edge information to a given CSV (comma-separated values) file. The format is 'source_node, target_node, weight]'.
	ToString	(Overrides Object.ToString().)
	TrimEdgeExcess	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	TryGetEdge	(Inherited from **UndirectedGraph**(UInt32, Connection).)

Events

	Name	Description
	Cleared	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	EdgeAdded	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	EdgeRemoved	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	VertexAdded	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	VertexRemoved	(Inherited from **UndirectedGraph**(UInt32, Connection).)

See Also

Comuna Namespace

Network Constructor

Initializes a new instance of the Network class

Namespace: Comuna
Assembly: Comuna (in Comuna.dll) Version: 1.0.0

Syntax

C#

```
public Network()
```

View Source

See Also

Network Class
Comuna Namespace

Network.Network Properties

The Network type exposes the following members.

Properties

	Name	Description
	AllowParallelEdges	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	EdgeCapacity	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	EdgeCount	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	EdgeEqualityComparer	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	Edges	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	IsDirected	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	IsEdgesEmpty	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	IsVerticesEmpty	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	TotalWeight	Gets the total weight associated with all connections in this network.
	VertexCount	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	Vertices	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	Weights	Gets the weights associated with each node in this network.

See Also

Network Class

Comuna Namespace

Network.TotalWeight Property

Gets the total weight associated with all connections in this network.

Namespace: Comuna
Assembly: Comuna (in Comuna.dll) Version: 1.0.0

Syntax

C#

```
public double TotalWeight { get; }
```

View Source

Property Value

Type: Double

See Also

Network Class
Comuna Namespace

Network.Weights Property

Gets the weights associated with each node in this network.

Namespace: Comuna
Assembly: Comuna (in Comuna.dll) Version: 1.0.0

Syntax

C#

```
public IReadOnlyDictionary<uint, double> Weights { get; }
```

View Source

Property Value

Type: IReadOnlyDictionary(UInt32, Double)

See Also

Network Class
Comuna Namespace

Network.Network Methods

The Network type exposes the following members.

Methods

	Name	Description
	AddEdge	Adds a new Connection to the network.
	AddEdgeRange	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	AddVertex	Adds a new node to the network.
	AddVertexRange	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	AddVerticesAndEdge	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	AddVerticesAndEdgeRange	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	AdjacentDegree	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	AdjacentEdge	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	AdjacentEdges	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	Clear	Removes all nodes and connections from this network.
	ClearAdjacentEdges	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	ClearConnections	Removes all connections from this network.
	ClearNodes	Removes all nodes from this network.
	ContainsEdge(UTP)	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	ContainsEdge(UTP, UTP)	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	ContainsVertex	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	Dispose	
	Equals	(Inherited from Object.)
	Finalize	(Inherited from Object.)
	GetHashCode	(Inherited from Object.)
	GetType	(Inherited from Object.)
	IsAdjacentEdgesEmpty	(Inherited from **UndirectedGraph**(UInt32, Connection).)
S	LoadFromCsv	Creates a new Network by reading the edge information stored in the given CSV (comma-separated values) file. The format is 'source_node, target_node [, weight]'. If not provided, weight of the edge is considered to be 1.
	MemberwiseClone	(Inherited from Object.)
	OnEdgeAdded	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	OnEdgeRemoved	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	OnVertexAdded	(Inherited from **UndirectedGraph**(UInt32, Connection).)
	OnVertexRemoved	(Inherited from **UndirectedGraph**(UInt32, Connection).)

◆	**RemoveAdjacentEdgeIf**	(Inherited from **UndirectedGraph**(UInt32, Connection).)
◆	RemoveEdge	Removes the given Connection from the network and updates weights.
◆	**RemoveEdgeIf**	(Inherited from **UndirectedGraph**(UInt32, Connection).)
◆	**RemoveEdges**	(Inherited from **UndirectedGraph**(UInt32, Connection).)
◆	RemoveVertex	Removes the given node (ID) from the network and updates weights.
◆	**RemoveVertexIf**	(Inherited from **UndirectedGraph**(UInt32, Connection).)
◆	SaveToCsv	Writes the network's edge information to a given CSV (comma-separated values) file. The format is 'source_node, target_node, weight]'.
◆	ToString	(Overrides Object.ToString().)
◆	**TrimEdgeExcess**	(Inherited from **UndirectedGraph**(UInt32, Connection).)
◆	**TryGetEdge**	(Inherited from **UndirectedGraph**(UInt32, Connection).)

See Also

Network Class
Comuna Namespace

Network.AddEdge Method

Adds a new Connection to the network.

Namespace: Comuna
Assembly: Comuna (in Comuna.dll) Version: 1.0.0

Syntax

C#

```
public bool AddEdge(
        Connection connection
)
```

View Source

Parameters

connection
Type: Comuna.Connection
The connection to be added.

Return Value

Type: Boolean
A Boolean indicating whether the connection was successfully added.

See Also

Network Class
Comuna Namespace

Network.AddVertex Method

Adds a new node to the network.

Namespace: Comuna
Assembly: Comuna (in Comuna.dll) Version: 1.0.0

Syntax

C#

```
public bool AddVertex(
            uint node
)
```

View Source

Parameters

node
Type: System.UInt32
The node (ID) to be added to the network.

Return Value

Type: Boolean
A Boolean indicating whether the node was successfully added.

See Also

Network Class
Comuna Namespace

Network.Clear Method

Removes all nodes and connections from this network.

Namespace: Comuna
Assembly: Comuna (in Comuna.dll) Version: 1.0.0

Syntax

C#

```
public void Clear()
```

View Source

See Also

Network Class
Comuna Namespace

Network.ClearConnections Method

Removes all connections from this network.

Namespace: Comuna
Assembly: Comuna (in Comuna.dll) Version: 1.0.0

Syntax

C#

```
public void ClearConnections()
```

View Source

See Also

Network Class
Comuna Namespace

Network.ClearNodes Method

Removes all nodes from this network.

Namespace: Comuna
Assembly: Comuna (in Comuna.dll) Version: 1.0.0

Syntax

C#

```
public void ClearNodes()
```

View Source

See Also

Network Class
Comuna Namespace

Network.Dispose Method

Releases all resources used by the Network

Namespace: Comuna
Assembly: Comuna (in Comuna.dll) Version: 1.0.0

Syntax

C#

```
public void Dispose()
```

View Source

Implements
IDisposable.Dispose()

See Also

Network Class
Comuna Namespace

Network.LoadFromCsv Method

Creates a new Network by reading the edge information stored in the given CSV (comma-separated values) file. The format is 'source_node, target_node [, weight]'. If not provided, weight of the edge is considered to be 1.

Namespace: Comuna
Assembly: Comuna (in Comuna.dll) Version: 1.0.0

Syntax

C#

```
public static Network LoadFromCsv(
	string filePath,
	char sepChar = ','
)
```

View Source

Parameters

filePath
Type: System.String
The path to the CSV file containing the network information.

sepChar (Optional)
Type: System.Char
The character used to separate each field in the file.

Return Value

Type: Network
A new network according to the information in the given file, or null if no information could be read.

See Also

Network Class
Comuna Namespace

Network.RemoveEdge Method

Removes the given Connection from the network and updates weights.

Namespace: Comuna
Assembly: Comuna (in Comuna.dll) Version: 1.0.0

Syntax

C#

```
public bool RemoveEdge(
	Connection connection
)
```

View Source

Parameters

connection
Type: Comuna.Connection
The connection to be removed.

Return Value

Type: Boolean
A Boolean indicating whether the connection was successfully removed.

See Also

Network Class
Comuna Namespace

Network.RemoveVertex Method

Removes the given node (ID) from the network and updates weights.

Namespace: Comuna
Assembly: Comuna (in Comuna.dll) Version: 1.0.0

Syntax

C#

```
public bool RemoveVertex(
	uint node
)
```

View Source

Parameters

node
Type: System.UInt32
The node to be removed.

Return Value

Type: Boolean
A Boolean indicating whether the node was successfully removed.

See Also

Network Class
Comuna Namespace

Network.SaveToCsv Method

Writes the network's edge information to a given CSV (comma-separated values) file. The format is 'source_node, target_node, weight]'.

Namespace: Comuna
Assembly: Comuna (in Comuna.dll) Version: 1.0.0

Syntax

C#

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

View Source

Parameters

filePath
Type: System.String
The path to the CSV file in which to store the network information.

sepChar (Optional)
Type: System.Char
The character used to separate each field in the file.

See Also

Network Class
Comuna Namespace

Network.ToString Method

Namespace: Comuna
Assembly: Comuna (in Comuna.dll) Version: 1.0.0

Syntax

C#

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

View Source

Return Value

Type: String

See Also

Network Class
Comuna Namespace

Network.Network Events

The Network type exposes the following members.

Events

	Name	Description
⚡	**Cleared**	(Inherited from **UndirectedGraph**(UInt32, Connection).)
⚡	**EdgeAdded**	(Inherited from **UndirectedGraph**(UInt32, Connection).)
⚡	**EdgeRemoved**	(Inherited from **UndirectedGraph**(UInt32, Connection).)
⚡	**VertexAdded**	(Inherited from **UndirectedGraph**(UInt32, Connection).)
⚡	**VertexRemoved**	(Inherited from **UndirectedGraph**(UInt32, Connection).)

See Also

Network Class
Comuna Namespace

Comuna.D3 Namespace

Classes

	Class	Description
	CommunityTracker	A class that enables tracking the evolution of the communities in a Network over time while writing the changes to a D3 json file. The Network's connections and the CommunityAlgorithm are assumed to be updated outside of the tracker.
	D3Extensions	Contains extensions for CommunityAlgorithm objects to enable export to D3.js graph files.
	Graph	Represents a graph structure used to save a Network to a D3 json file.
	Link	Represents a link structure used to save a Connection to a D3 json file.
	Node	Represents a node structure used to save a node of a Network to a D3 json file.

CommunityTracker Class

A class that enables tracking the evolution of the communities in a Network over time while writing the changes to a D3 json file. The Network's connections and the CommunityAlgorithm are assumed to be updated outside of the tracker.

Inheritance Hierarchy

System.Object
  Comuna.D3.CommunityTracker

Namespace: Comuna.D3
Assembly: Comuna.D3 (in Comuna.D3.dll) Version: 1.0.0

Syntax

C#

```
public class CommunityTracker : IDisposable
```

View Source

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

Constructors

	Name	Description
	CommunityTracker	Creates a new **CommunityTracker** with the given algorithm and capacity.

Properties

	Name	Description
	CommunityAlg	Gets the community algorithm containing the Network used to update the communities.
	FilePath	Gets the path to the D3 json file where the network graphs are saved.
	Network	Gets the network graph whose communities are tracked by this instance.

Methods

	Name	Description
	Dispose	Disposes of this tracker by closing the D3 json file.
	Equals	(Inherited from Object.)
	Finalize	(Inherited from Object.)
	GetHashCode	(Inherited from Object.)
	GetType	(Inherited from Object.)
	MemberwiseClone	(Inherited from Object.)

◆	ToString	(Inherited from Object.)
◆	Update	

See Also

Comuna.D3 Namespace

CommunityTracker Constructor

Creates a new CommunityTracker with the given algorithm and capacity.

Namespace: Comuna.D3
Assembly: Comuna.D3 (in Comuna.D3.dll) Version: 1.0.0

Syntax

C#

```
public CommunityTracker(
	CommunityAlgorithm communityAlg,
	string filePath,
	uint maxUpdates,
	Formatting formatting = Formatting.None
)
```

View Source

Parameters

communityAlg
Type: Comuna.CommunityAlgorithm
The community algorithm containing the Network used to update the communities.

filePath
Type: System.String
The path to the file in which to save the network graph.

maxUpdates
Type: System.UInt32
The maximum number of updates to the communities to be tracked.

formatting (Optional)
Type: **Formatting**
The Json file formatting.

See Also

CommunityTracker Class
Comuna.D3 Namespace

CommunityTracker.CommunityTracker Properties

The CommunityTracker type exposes the following members.

Properties

	Name	Description
	CommunityAlg	Gets the community algorithm containing the Network used to update the communities.
	FilePath	Gets the path to the D3 json file where the network graphs are saved.
	Network	Gets the network graph whose communities are tracked by this instance.

See Also

CommunityTracker Class
Comuna.D3 Namespace

CommunityTracker.CommunityAlg Property

Gets the community algorithm containing the Network used to update the communities.

Namespace: Comuna.D3
Assembly: Comuna.D3 (in Comuna.D3.dll) Version: 1.0.0

Syntax

C#

```
public CommunityAlgorithm CommunityAlg { get; }
```

View Source

Property Value

Type: CommunityAlgorithm

See Also

CommunityTracker Class
Comuna.D3 Namespace

CommunityTracker.FilePath Property

Gets the path to the D3 json file where the network graphs are saved.

Namespace: Comuna.D3
Assembly: Comuna.D3 (in Comuna.D3.dll) Version: 1.0.0

Syntax

C#
`public string FilePath { get; }`

View Source

Property Value

Type: String

See Also

CommunityTracker Class
Comuna.D3 Namespace

CommunityTracker.Network Property

Gets the network graph whose communities are tracked by this instance.

Namespace: Comuna.D3
Assembly: Comuna.D3 (in Comuna.D3.dll) Version: 1.0.0

Syntax

C#

```
public Network Network { get; }
```

View Source

Property Value

Type: Network

See Also

CommunityTracker Class
Comuna.D3 Namespace

CommunityTracker.CommunityTracker Methods

The CommunityTracker type exposes the following members.

Methods

	Name	Description
	Dispose	Disposes of this tracker by closing the D3 json file.
	Equals	(Inherited from Object.)
	Finalize	(Inherited from Object.)
	GetHashCode	(Inherited from Object.)
	GetType	(Inherited from Object.)
	MemberwiseClone	(Inherited from Object.)
	ToString	(Inherited from Object.)
	Update	

See Also

CommunityTracker Class

Comuna.D3 Namespace

CommunityTracker.Dispose Method

Disposes of this tracker by closing the D3 json file.

Namespace: Comuna.D3
Assembly: Comuna.D3 (in Comuna.D3.dll) Version: 1.0.0

Syntax

C#

```
public void Dispose()
```

View Source

Implements
IDisposable.Dispose()

See Also

CommunityTracker Class
Comuna.D3 Namespace

CommunityTracker.Update Method

Namespace: Comuna.D3
Assembly: Comuna.D3 (in Comuna.D3.dll) Version: 1.0.0

Syntax

C#
public void Update()

View Source

See Also

CommunityTracker Class
Comuna.D3 Namespace

D3Extensions Class

Contains extensions for CommunityAlgorithm objects to enable export to D3.js graph files.

Inheritance Hierarchy

System.Object
  Comuna.D3.D3Extensions

Namespace: Comuna.D3
Assembly: Comuna.D3 (in Comuna.D3.dll) Version: 1.0.0

Syntax

C#
`public static class D3Extensions`

View Source

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

Methods

	Name	Description
S	ToD3GraphFile	Saves the network of the given CommunityAlgorithm to a d3.js graph file.

See Also

Comuna.D3 Namespace

D3Extensions.D3Extensions Methods

The D3Extensions type exposes the following members.

Methods

	Name	Description
S	ToD3GraphFile	Saves the network of the given CommunityAlgorithm to a d3.js graph file.

See Also

D3Extensions Class
Comuna.D3 Namespace

D3Extensions.ToD3GraphFile Method

Saves the network of the given CommunityAlgorithm to a d3.js graph file.

Namespace: Comuna.D3
Assembly: Comuna.D3 (in Comuna.D3.dll) Version: 1.0.0

Syntax

C#

```
public static void ToD3GraphFile(
	this CommunityAlgorithm communityAlg,
	string filePath,
	Formatting formatting = Formatting.None
)
```

View Source

Parameters

communityAlg
Type: Comuna.CommunityAlgorithm
The network to be saved to a graph file.

filePath
Type: System.String
The path to the file in which to save the network graph.

formatting (Optional)
Type: **Formatting**
The Json file formatting.

Usage Note

In Visual Basic and C#, you can call this method as an instance method on any object of type CommunityAlgorithm. 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

D3Extensions Class
Comuna.D3 Namespace

Graph Class

Represents a graph structure used to save a Network to a D3 json file.

Inheritance Hierarchy

System.Object
  Comuna.D3.Graph

Namespace: Comuna.D3
Assembly: Comuna.D3 (in Comuna.D3.dll) Version: 1.0.0

Syntax

C#

```
public class Graph
```

View Source

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

Constructors

	Name	Description
	Graph	Initializes a new instance of the **Graph** class

Properties

	Name	Description
	Links	Gets or sets the list of Link in this graph.
	Nodes	Gets or sets the list of Node in this graph.

Methods

	Name	Description
	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

Comuna.D3 Namespace

Graph Constructor

Initializes a new instance of the Graph class

Namespace: Comuna.D3
Assembly: Comuna.D3 (in Comuna.D3.dll) Version: 1.0.0

Syntax

C#

```
public Graph()
```

View Source

See Also

Graph Class
Comuna.D3 Namespace

Graph.Graph Properties

The Graph type exposes the following members.

Properties

	Name	Description
	Links	Gets or sets the list of Link in this graph.
	Nodes	Gets or sets the list of Node in this graph.

See Also

Graph Class
Comuna.D3 Namespace

Graph.Links Property

Gets or sets the list of Link in this graph.

Namespace: Comuna.D3
Assembly: Comuna.D3 (in Comuna.D3.dll) Version: 1.0.0

Syntax

C#

```
public List<Link> Links { get; }
```

View Source

Property Value

Type: List(Link)

See Also

Graph Class
Comuna.D3 Namespace

Graph.Nodes Property

Gets or sets the list of Node in this graph.

Namespace: Comuna.D3
Assembly: Comuna.D3 (in Comuna.D3.dll) Version: 1.0.0

Syntax

C#

```
public List<Node> Nodes { get; }
```

View Source

Property Value

Type: List(Node)

See Also

Graph Class
Comuna.D3 Namespace

Graph.Graph Methods

The Graph type exposes the following members.

Methods

	Name	Description
	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

Graph Class
Comuna.D3 Namespace

Link Class

Represents a link structure used to save a Connection to a D3 json file.

Inheritance Hierarchy

System.Object
  Comuna.D3.Link

Namespace: Comuna.D3
Assembly: Comuna.D3 (in Comuna.D3.dll) Version: 1.0.0

Syntax

C#
public class Link

View Source

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

Constructors

	Name	Description
	Link	Initializes a new instance of the **Link** class

Properties

	Name	Description
	Source	Gets or sets the ID of the source node of this link.
	Target	Gets or sets the ID of the target node of this link.
	Value	Gets or sets the value / weight associated with this link.

Methods

	Name	Description
	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

Comuna.D3 Namespace

Link Constructor

Initializes a new instance of the Link class

Namespace: Comuna.D3
Assembly: Comuna.D3 (in Comuna.D3.dll) Version: 1.0.0

Syntax

C#

```
public Link()
```

View Source

See Also

Link Class
Comuna.D3 Namespace

Link.Link Properties

The Link type exposes the following members.

Properties

	Name	Description
	Source	Gets or sets the ID of the source node of this link.
	Target	Gets or sets the ID of the target node of this link.
	Value	Gets or sets the value / weight associated with this link.

See Also

Link Class

Comuna.D3 Namespace

Link.Source Property

Gets or sets the ID of the source node of this link.

Namespace: Comuna.D3
Assembly: Comuna.D3 (in Comuna.D3.dll) Version: 1.0.0

Syntax

C#

```
public uint Source { get; set; }
```

View Source

Property Value

Type: UInt32

See Also

Link Class
Comuna.D3 Namespace

Link.Target Property

Gets or sets the ID of the target node of this link.

Namespace: Comuna.D3
Assembly: Comuna.D3 (in Comuna.D3.dll) Version: 1.0.0

Syntax

C#

```
public uint Target { get; set; }
```

View Source

Property Value

Type: UInt32

See Also

Link Class
Comuna.D3 Namespace

Link.Value Property

Gets or sets the value / weight associated with this link.

Namespace: Comuna.D3
Assembly: Comuna.D3 (in Comuna.D3.dll) Version: 1.0.0

Syntax

C#

```
public double Value { get; set; }
```

View Source

Property Value

Type: Double

See Also

Link Class
Comuna.D3 Namespace

Link.Link Methods

The Link type exposes the following members.

Methods

	Name	Description
	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

Link Class

Comuna.D3 Namespace

Node Class

Represents a node structure used to save a node of a Network to a D3 json file.

Inheritance Hierarchy

System.Object
  Comuna.D3.Node

Namespace: Comuna.D3
Assembly: Comuna.D3 (in Comuna.D3.dll) Version: 1.0.0

Syntax

C#
public class Node

View Source

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

Constructors

	Name	Description
◆	Node	Creates a new **Node** with the given ID.

Properties

	Name	Description
▤	Community	Gets or sets the ID of the community of this node.
▤	ID	Gets or sets the ID of this node.
▤	IdNum	Gets or sets the ID of this node.

Methods

	Name	Description
◆	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

Comuna.D3 Namespace

Node Constructor

Creates a new Node with the given ID.

Namespace: Comuna.D3
Assembly: Comuna.D3 (in Comuna.D3.dll) Version: 1.0.0

Syntax

C#

```
public Node(
	uint id,
	uint community = 0
)
```

View Source

Parameters

id
Type: System.UInt32
The id of the node.

community (Optional)
Type: System.UInt32
The id of the community of this node

See Also

Node Class
Comuna.D3 Namespace

Node.Node Properties

The Node type exposes the following members.

Properties

	Name	Description
	Community	Gets or sets the ID of the community of this node.
	ID	Gets or sets the ID of this node.
	IdNum	Gets or sets the ID of this node.

See Also

Node Class

Comuna.D3 Namespace

Node.Community Property

Gets or sets the ID of the community of this node.

Namespace: Comuna.D3
Assembly: Comuna.D3 (in Comuna.D3.dll) Version: 1.0.0

Syntax

C#

```
public uint Community { get; set; }
```

View Source

Property Value

Type: UInt32

See Also

Node Class
Comuna.D3 Namespace

Node.ID Property

Gets or sets the ID of this node.

Namespace: Comuna.D3
Assembly: Comuna.D3 (in Comuna.D3.dll) Version: 1.0.0

Syntax

C#

```
public string ID { get; set; }
```

View Source

Property Value

Type: String

See Also

Node Class
Comuna.D3 Namespace

Node.IdNum Property

Gets or sets the ID of this node.

Namespace: Comuna.D3
Assembly: Comuna.D3 (in Comuna.D3.dll) Version: 1.0.0

Syntax

C#

```
public uint IdNum { get; set; }
```

View Source

Property Value

Type: UInt32

See Also

Node Class
Comuna.D3 Namespace

Node.Node Methods

The Node type exposes the following members.

Methods

	Name	Description
	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

Node Class
Comuna.D3 Namespace

Comuna.Graphviz Namespace

Classes

	Class	Description
	Edge	Represents an edge structure used to save a connection of a Network to a Graphviz dot file.
	Extensions	Provides extension methods to print Network objects with community information to image files using Graphviz.
	Node	Represents a node structure used to save a node of a Network to a Graphviz dot file.
	TolPalettes	Allows the generation of [**!:Color**] palettes according to Paul Tol's color schemes. http://www.sron.nl/~pault/colourschemes.pdf

Delegates

	Delegate	Description
	PaletteGenerator	Represents a generator for color palettes based on a number of elements.

Edge Class

Represents an edge structure used to save a connection of a Network to a Graphviz dot file.

Inheritance Hierarchy

System.Object
  Comuna.Graphviz.Edge

Namespace: Comuna.Graphviz
Assembly: Comuna.Graphviz (in Comuna.Graphviz.dll) Version: 1.0.0

Syntax

C#
public class Edge : IUndirectedEdge<Node>, IEdge<Node>

View Source

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

Constructors

	Name	Description
	Edge	Creates a new **Edge** linking the given source and target with the associated weight.

Properties

	Name	Description
	ShowLabel	Gets or sets a value indicating whether to show the edge's label.
	Source	Gets the source node.
	Target	Gets the target node.
	Weight	Gets the weight associated with this connection.

Methods

	Name	Description
	Equals(Object)	(Overrides Object.Equals(Object).)
	Equals(Edge)	Tests whether this connection is equal to another one.
	Finalize	(Inherited from Object.)
	GetHashCode	(Overrides Object.GetHashCode().)
	GetType	(Inherited from Object.)
	MemberwiseClone	(Inherited from Object.)
	ToString	(Overrides Object.ToString().)

Operators

	Name	Description
S	Equality	Tests whether the two connections are equal.
S	Inequality	Tests whether the two connections are different (not equal).

See Also

Comuna.Graphviz Namespace

Edge Constructor

Creates a new Edge linking the given source and target with the associated weight.

Namespace: Comuna.Graphviz
Assembly: Comuna.Graphviz (in Comuna.Graphviz.dll) Version: 1.0.0

Syntax

C#

```
public Edge(
            Node source,
            Node target,
            double weight = 1
)
```

View Source

Parameters

source
Type: Comuna.Graphviz.Node
The source of the connection.

target
Type: Comuna.Graphviz.Node
The target of the connection.

weight (Optional)
Type: System.Double
The weight associated with the connection.

See Also

Edge Class
Comuna.Graphviz Namespace

Edge.Edge Properties

The Edge type exposes the following members.

Properties

	Name	Description
	ShowLabel	Gets or sets a value indicating whether to show the edge's label.
	Source	Gets the source node.
	Target	Gets the target node.
	Weight	Gets the weight associated with this connection.

See Also

Edge Class

Comuna.Graphviz Namespace

Edge.ShowLabel Property

Gets or sets a value indicating whether to show the edge's label.

Namespace: Comuna.Graphviz
Assembly: Comuna.Graphviz (in Comuna.Graphviz.dll) Version: 1.0.0

Syntax

C#

```
public bool ShowLabel { get; set; }
```

View Source

Property Value

Type: Boolean

See Also

Edge Class
Comuna.Graphviz Namespace

Edge.Source Property

Gets the source node.

Namespace: Comuna.Graphviz
Assembly: Comuna.Graphviz (in Comuna.Graphviz.dll) Version: 1.0.0

Syntax

C#

```
public Node Source { get; }
```

View Source

Property Value

Type: Node

Implements

IEdge.Source

See Also

Edge Class
Comuna.Graphviz Namespace

Edge.Target Property

Gets the target node.

Namespace: Comuna.Graphviz
Assembly: Comuna.Graphviz (in Comuna.Graphviz.dll) Version: 1.0.0

Syntax

C#

```
public Node Target { get; }
```

View Source

Property Value

Type: Node

Implements

IEdge.Target

See Also

Edge Class
Comuna.Graphviz Namespace

Edge.Weight Property

Gets the weight associated with this connection.

Namespace: Comuna.Graphviz
Assembly: Comuna.Graphviz (in Comuna.Graphviz.dll) Version: 1.0.0

Syntax

C#

```
public double Weight { get; }
```

View Source

Property Value

Type: Double

See Also

Edge Class
Comuna.Graphviz Namespace

Edge.Edge Methods

The Edge type exposes the following members.

Methods

	Name	Description
	Equals(Object)	(Overrides Object.Equals(Object).)
	Equals(Edge)	Tests whether this connection is equal to another one.
	Finalize	(Inherited from Object.)
	GetHashCode	(Overrides Object.GetHashCode().)
	GetType	(Inherited from Object.)
	MemberwiseClone	(Inherited from Object.)
	ToString	(Overrides Object.ToString().)

See Also

Edge Class
Comuna.Graphviz Namespace

Edge.Equals Method

Overload List

	Name	Description
◆	Equals(Object)	(Overrides Object.Equals(Object).)
◆	Equals(Edge)	Tests whether this connection is equal to another one.

See Also

Edge Class

Comuna.Graphviz Namespace

Edge.Equals Method (Object)

Namespace: Comuna.Graphviz

Assembly: Comuna.Graphviz (in Comuna.Graphviz.dll) Version: 1.0.0

Syntax

C#

```
public override bool Equals(
	Object obj
)
```

View Source

Parameters

obj

Type: System.Object

Return Value

Type: Boolean

See Also

Edge Class

Equals Overload

Comuna.Graphviz Namespace

Edge.Equals Method (Edge)

Tests whether this connection is equal to another one.

Namespace: Comuna.Graphviz
Assembly: Comuna.Graphviz (in Comuna.Graphviz.dll) Version: 1.0.0

Syntax

C#

```
public bool Equals(
	Edge other
)
```

View Source

Parameters

other
Type: Comuna.Graphviz.Edge
The other connection.

Return Value

Type: Boolean
A Boolean indicating whether this connection is equal to the other one.

See Also

Edge Class
Equals Overload
Comuna.Graphviz Namespace

Edge.GetHashCode Method

Namespace: Comuna.Graphviz
Assembly: Comuna.Graphviz (in Comuna.Graphviz.dll) Version: 1.0.0

Syntax

C#

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

View Source

Return Value

Type: Int32

See Also

Edge Class
Comuna.Graphviz Namespace

Edge.ToString Method

Namespace: Comuna.Graphviz
Assembly: Comuna.Graphviz (in Comuna.Graphviz.dll) Version: 1.0.0

Syntax

C#

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

View Source

Return Value

Type: String

See Also

Edge Class
Comuna.Graphviz Namespace

Edge.Edge Operators

The Edge type exposes the following members.

Operators

	Name	Description
S	Equality	Tests whether the two connections are equal.
S	Inequality	Tests whether the two connections are different (not equal).

See Also

Edge Class

Comuna.Graphviz Namespace

Edge.Equality Operator

Tests whether the two connections are equal.

Namespace: Comuna.Graphviz
Assembly: Comuna.Graphviz (in Comuna.Graphviz.dll) Version: 1.0.0

Syntax

C#

```
public static bool operator ==(
	Edge left,
	Edge right
)
```

View Source

Parameters

left
Type: Comuna.Graphviz.Edge
The first connection.

right
Type: Comuna.Graphviz.Edge
The second connection.

Return Value

Type: Boolean
A Boolean indicating whether the two connections are equal.

See Also

Edge Class
Comuna.Graphviz Namespace

Edge.Inequality Operator

Tests whether the two connections are different (not equal).

Namespace: Comuna.Graphviz
Assembly: Comuna.Graphviz (in Comuna.Graphviz.dll) Version: 1.0.0

Syntax

C#

```
public static bool operator !=(
	Edge left,
	Edge right
)
```

View Source

Parameters

left
Type: Comuna.Graphviz.Edge
The first connection.

right
Type: Comuna.Graphviz.Edge
The second connection.

Return Value

Type: Boolean
A Boolean indicating whether the two connections are different.

See Also

Edge Class
Comuna.Graphviz Namespace

Extensions Class

Provides extension methods to print Network objects with community information to image files using Graphviz.

Inheritance Hierarchy

System.Object
  Comuna.Graphviz.Extensions

Namespace: Comuna.Graphviz
Assembly: Comuna.Graphviz (in Comuna.Graphviz.dll) Version: 1.0.0

Syntax

C#

```
public static class Extensions
```

View Source

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

Methods

	Name	Description
S	ToGraphvizFile	Saves the given Network to an image file.

See Also

Comuna.Graphviz Namespace

Extensions.Extensions Methods

The Extensions type exposes the following members.

Methods

	Name	Description
S	ToGraphvizFile	Saves the given Network to an image file.

See Also

Extensions Class
Comuna.Graphviz Namespace

Extensions.ToGraphvizFile Method

Saves the given Network to an image file.

Namespace: Comuna.Graphviz
Assembly: Comuna.Graphviz (in Comuna.Graphviz.dll) Version: 1.0.0

Syntax

C#

```
public static string ToGraphvizFile(
        this CommunityAlgorithm communityAlg,
        string basePath,
        string fileName,
        bool showLabels = true,
        GraphvizImageType imageType = GraphvizImageType.Pdf,
        PaletteGenerator paletteGenerator = null,
        int timeout = 2000
)
```

View Source

Parameters

communityAlg
Type: Comuna.CommunityAlgorithm
The root node of the tree to be saved.

basePath
Type: System.String
The path in which to save the given tree

fileName
Type: System.String
The name of the image file to be saved (without extension)

showLabels (Optional)
Type: System.Boolean
Whether to show nodes' labels.

imageType (Optional)
Type: **GraphvizImageType**
The type of image file in which to save the tree.

paletteGenerator (Optional)
Type: Comuna.Graphviz.PaletteGenerator
The color palette generator used to represent the different communities.

timeout (Optional)
Type: System.Int32
The maximum time to wait for Graphviz to create the image file.

Return Value

Type: String
The path to the file where the tree image file was saved.

Usage Note

In Visual Basic and C#, you can call this method as an instance method on any object of type CommunityAlgorithm. 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
Comuna.Graphviz Namespace

Node Class

Represents a node structure used to save a node of a Network to a Graphviz dot file.

Inheritance Hierarchy

System.Object
  Comuna.Graphviz.Node

Namespace: Comuna.Graphviz
Assembly: Comuna.Graphviz (in Comuna.Graphviz.dll) Version: 1.0.0

Syntax

C#
public class Node

View Source

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

Constructors

	Name	Description
	Node	Creates a new **Node** with the given ID.

Properties

	Name	Description
	Color	Gets or sets the node's color.
	Community	Gets or sets the ID of the community of this node.
	IdNum	Gets or sets the ID of this node.
	ShowLabel	Gets or sets a value indicating whether to show the node's label.

Methods

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

Operators

	Name	Description
S	Equality	Tests whether the two nodes are equal.
S	Inequality	Tests whether the two nodes are different (not equal).

See Also

Comuna.Graphviz Namespace

Node Constructor

Creates a new Node with the given ID.

Namespace: Comuna.Graphviz
Assembly: Comuna.Graphviz (in Comuna.Graphviz.dll) Version: 1.0.0

Syntax

C#

```
public Node(
	uint id,
	uint community = 0
)
```

View Source

Parameters

id
Type: System.UInt32
The id of the node.

community (Optional)
Type: System.UInt32
The id of the community of this node

See Also

Node Class
Comuna.Graphviz Namespace

Node.Node Properties

The Node type exposes the following members.

Properties

	Name	Description
	Color	Gets or sets the node's color.
	Community	Gets or sets the ID of the community of this node.
	IdNum	Gets or sets the ID of this node.
	ShowLabel	Gets or sets a value indicating whether to show the node's label.

See Also

Node Class

Comuna.Graphviz Namespace

Node.Color Property

Gets or sets the node's color.

Namespace: Comuna.Graphviz
Assembly: Comuna.Graphviz (in Comuna.Graphviz.dll) Version: 1.0.0

Syntax

C#

```
public GraphvizColor Color { get; set; }
```

View Source

Property Value

Type: **GraphvizColor**

See Also

Node Class
Comuna.Graphviz Namespace

Node.Community Property

Gets or sets the ID of the community of this node.

Namespace: Comuna.Graphviz
Assembly: Comuna.Graphviz (in Comuna.Graphviz.dll) Version: 1.0.0

Syntax

C#

```
public uint Community { get; }
```

View Source

Property Value

Type: UInt32

See Also

Node Class
Comuna.Graphviz Namespace

Node.IdNum Property

Gets or sets the ID of this node.

Namespace: Comuna.Graphviz
Assembly: Comuna.Graphviz (in Comuna.Graphviz.dll) Version: 1.0.0

Syntax

C#

```
public uint IdNum { get; }
```

View Source

Property Value

Type: UInt32

See Also

Node Class
Comuna.Graphviz Namespace

Node.ShowLabel Property

Gets or sets a value indicating whether to show the node's label.

Namespace: Comuna.Graphviz
Assembly: Comuna.Graphviz (in Comuna.Graphviz.dll) Version: 1.0.0

Syntax

C#

```
public bool ShowLabel { get; set; }
```

View Source

Property Value

Type: Boolean

See Also

Node Class
Comuna.Graphviz Namespace

Node.Node Methods

The Node type exposes the following members.

Methods

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

See Also

Node Class
Comuna.Graphviz Namespace

Node.Equals Method

Namespace: Comuna.Graphviz

Assembly: Comuna.Graphviz (in Comuna.Graphviz.dll) Version: 1.0.0

Syntax

C#

```
public override bool Equals(
	Object obj
)
```

View Source

Parameters

obj

Type: System.Object

Return Value

Type: Boolean

See Also

Node Class

Comuna.Graphviz Namespace

Node.GetHashCode Method

Namespace: Comuna.Graphviz
Assembly: Comuna.Graphviz (in Comuna.Graphviz.dll) Version: 1.0.0

Syntax

C#

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

View Source

Return Value

Type: Int32

See Also

Node Class
Comuna.Graphviz Namespace

Node.Node Operators

The Node type exposes the following members.

Operators

	Name	Description
S	Equality	Tests whether the two nodes are equal.
S	Inequality	Tests whether the two nodes are different (not equal).

See Also

Node Class

Comuna.Graphviz Namespace

Node.Equality Operator

Tests whether the two nodes are equal.

Namespace: Comuna.Graphviz
Assembly: Comuna.Graphviz (in Comuna.Graphviz.dll) Version: 1.0.0

Syntax

C#

```
public static bool operator ==(
	Node left,
	Node right
)
```

View Source

Parameters

left
Type: Comuna.Graphviz.Node
The first node.

right
Type: Comuna.Graphviz.Node
The second node.

Return Value

Type: Boolean
A Boolean indicating whether the two nodes are equal.

See Also

Node Class
Comuna.Graphviz Namespace

Node.Inequality Operator

Tests whether the two nodes are different (not equal).

Namespace: Comuna.Graphviz
Assembly: Comuna.Graphviz (in Comuna.Graphviz.dll) Version: 1.0.0

Syntax

C#

```
public static bool operator !=(
            Node left,
            Node right
)
```

View Source

Parameters

left
Type: Comuna.Graphviz.Node
The first node.

right
Type: Comuna.Graphviz.Node
The second node.

Return Value

Type: Boolean
A Boolean indicating whether the two nodes are different.

See Also

Node Class
Comuna.Graphviz Namespace

PaletteGenerator Delegate

Represents a generator for color palettes based on a number of elements.

Namespace: Comuna.Graphviz
Assembly: Comuna.Graphviz (in Comuna.Graphviz.dll) Version: 1.0.0

Syntax

C#

```
public delegate GraphvizColor[] PaletteGenerator(
	int numColors
)
```

Parameters

numColors
Type: System.Int32
The number of colors to be generated.

Return Value

Type: **GraphvizColor**[]
An array of **GraphvizColor** of the given size.

See Also

Comuna.Graphviz Namespace

TolPalettes Class

Allows the generation of **[!:Color]** palettes according to Paul Tol's color schemes. http://www.sron.nl/~pault/colourschemes.pdf

Inheritance Hierarchy

System.Object
  Comuna.Graphviz.TolPalettes

Namespace: Comuna.Graphviz
Assembly: Comuna.Graphviz (in Comuna.Graphviz.dll) Version: 1.0.0

Syntax

C#

```
public static class TolPalettes
```

View Source

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

Methods

	Name	Description
S	CreateTolDivPalette	Creates a color palette according to Paul Tol's diverging (blue-yellow-red) colors scheme. http://www.sron.nl/~pault/colourschemes.pdf, Fig. 8 and Eq. 2.
S	CreateTolRainbowPalette	Creates a color palette according to Paul Tol's rainbow colors scheme. http://www.sron.nl/~pault/colourschemes.pdf, Fig. 13 and Eq. 3.

See Also

Comuna.Graphviz Namespace

TolPalettes.TolPalettes Methods

The TolPalettes type exposes the following members.

Methods

	Name	Description
S	CreateTolDivPalette	Creates a color palette according to Paul Tol's diverging (blue-yellow-red) colors scheme. http://www.sron.nl/~pault/colourschemes.pdf, Fig. 8 and Eq. 2.
S	CreateTolRainbowPalette	Creates a color palette according to Paul Tol's rainbow colors scheme. http://www.sron.nl/~pault/colourschemes.pdf, Fig. 13 and Eq. 3.

See Also

TolPalettes Class
Comuna.Graphviz Namespace

TolPalettes.CreateTolDivPalette Method

Creates a color palette according to Paul Tol's diverging (blue-yellow-red) colors scheme. http://www.sron.nl/~pault/colourschemes.pdf, Fig. 8 and Eq. 2.

Namespace: Comuna.Graphviz
Assembly: Comuna.Graphviz (in Comuna.Graphviz.dll) Version: 1.0.0

Syntax

C#

```
public static GraphvizColor[] CreateTolDivPalette(
	int numColors
)
```

View Source

Parameters

numColors
Type: System.Int32
The number of colors to be generated in the palette.

Return Value

Type: **GraphvizColor**[]
A **GraphvizColor** array with the given number of colors.

See Also

TolPalettes Class
Comuna.Graphviz Namespace

TolPalettes.CreateTolRainbowPalette Method

Creates a color palette according to Paul Tol's rainbow colors scheme. http://www.sron.nl/~pault/colourschemes.pdf, Fig. 13 and Eq. 3.

Namespace: Comuna.Graphviz
Assembly: Comuna.Graphviz (in Comuna.Graphviz.dll) Version: 1.0.0

Syntax

C#

```
public static GraphvizColor[] CreateTolRainbowPalette(
	int numColors
)
```

View Source

Parameters

numColors
Type: System.Int32
The number of colors to be generated in the palette.

Return Value

Type: **GraphvizColor**[]
A **GraphvizColor** array with the given number of colors.

See Also

TolPalettes Class
Comuna.Graphviz Namespace