# graph_ricci_curvature

0.1.0

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# Chapter 1

# graph_ricci_curvature

Calculate Ricci Curvature for a networkx graph

## 1.1 Installation

### 1.1.1 From Source

- Clone the repository and `cd` into it
- Install python's `build`: `python -m pip install build`
- Build the project: `python -m build`
- Install the package: `python -m pip install dist/[file name].whl`

### 1.1.2 Download the .whl from Releases

Not done yet

### 1.1.3 From PyPi

Not done yet

## 1.2 Usage

After installation:

```
from graph_ricci_curvature.ollivier_ricci_curvature import OllivierRicciCurvature
import networkx as nx
G = nx.Graph()
G.add_nodes_from([1, 2, 3])
G.add_edges_from([(1, 2), (1, 3)])
g = OllivierRicciCurvature(G)
g._calculate_ricci_curvature()
print(list(g.G.edges.data()))
print(list(g.G.nodes.data()))
print(g.G.graph["graph_ricci_curvature"], g.G.graph["norm_graph_ricci_curvature"])
```

Output:

```
[
(1, 2, {"weight": 1.0, "ricci_curvature": 0.5}),
(1, 3, {"weight": 1.0, "ricci_curvature": 0.5}),
]
[
(1, {'ricci_curvature': 0.5}),
(2, {'ricci_curvature': 0.5}),
(3, {'ricci_curvature': 0.5})
]
1.5 0.5
```

# Chapter 2

# Hierarchical Index

## 2.1 Class Hierarchy

This inheritance list is sorted roughly, but not completely, alphabetically:

# Chapter 3

# Class Index

## 3.1 Class List

Here are the classes, structs, unions and interfaces with brief descriptions:

# Chapter 4

# Namespace Documentation

## 4.1 graph_ricci_curvature.ollivier_ricci_curvature Namespace Reference

### Classes

- class OllivierRicciCurvature

### 4.1.1 Detailed Description

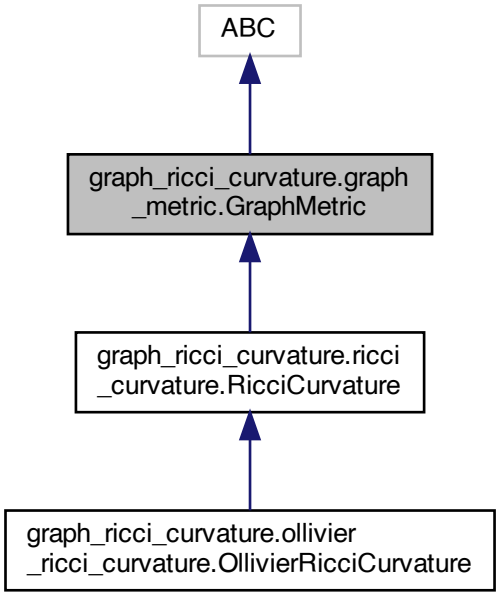
```
References:
    - Ollivier, Y. 2009. "Ricci curvature of Markov chains on metric spaces". Journal of Functional Analysis,
    - Sandhu et al. 2015. "Graph Curvature for Differentiating Cancer Networks". Scientific Reports. DOi: 10.1
```

# Chapter 5

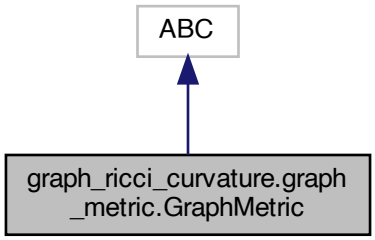
# Class Documentation

## 5.1 graph_ricci_curvature.graph_metric.GraphMetric Class Reference

Inheritance diagram for graph_ricci_curvature.graph_metric.GraphMetric:



Collaboration diagram for graph_ricci_curvature.graph_metric.GraphMetric:




## Public Member Functions

- def **__init__** (self, nx.Graph G, weight_key)

## Public Attributes

- **G**
- **weight_key**

### 5.1.1 Detailed Description

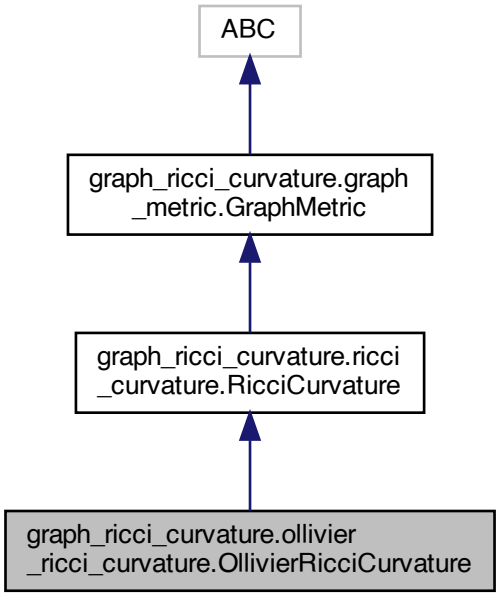
```
Parent class for classes calculating properties of a graph

Parameters
----------
G : networkx graph
    Input graph
weight_key : str
    key to specify edge weights in networkx dictionary
```

The documentation for this class was generated from the following file:

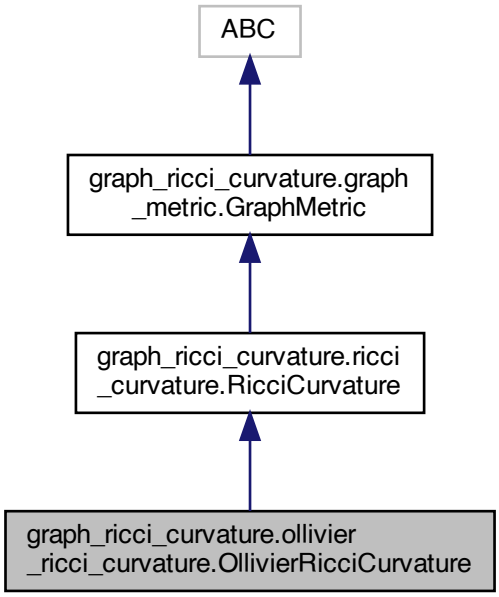
- graph_ricci_curvature/graph_metric.py

## 5.2 graph_ricci_curvature.ollivier_ricci_curvature.OllivierRicciCurvature Class Reference

Inheritance diagram for graph_ricci_curvature.ollivier_ricci_curvature.OllivierRicciCurvature:



Collaboration diagram for graph_ricci_curvature.ollivier_ricci_curvature.OllivierRicciCurvature:




## Public Member Functions

- def **__init__** (self, nx.Graph G, weight_key="weight")
- def calculate_ricci_curvature (self, alpha=0.5, norm=True)
- def calculate_edge_curvature (self, source_node, target_node, alpha=0.5)

## Additional Inherited Members

### 5.2.1 Detailed Description

```
Class for calculating Ollivier Ricci Curvature

Parameters
----------
G : networkx graph
    Input graph
weight_key : str
    key to specify edge weights in networkx dictionary. Default = weight
```

### 5.2.2 Member Function Documentation

#### 5.2.2.1 calculate_edge_curvature()

```
def graph_ricci_curvature.ollivier_ricci_curvature.OllivierRicciCurvature.calculate_edge_↩
curvature (
              self,
              source_node,
              target_node,
              alpha = 0.5 )


Calculate value of Ricci Curvature tensor associated with an edge
between a source and target node defined as

1 - ( Wasserstein 1 Distance / Edge Weight )

Parameters
----------
source_node : int or tuple
    index of source_node in graph self.G
target_node : int or tuple
    index of target node in graph self.G
alpha : float
    hyperparameter (0 <= alpha <=1) determining how much mass to move
    from node

Returns
-------
curvature : float
    value of curvature tensor
```

#### 5.2.2.2 calculate_ricci_curvature()

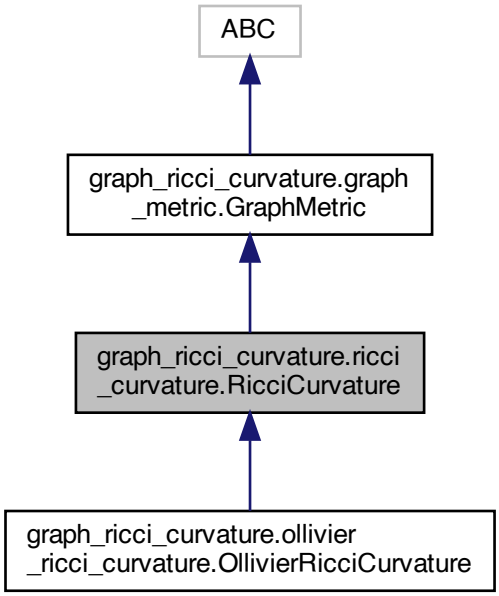
```
def graph_ricci_curvature.ollivier_ricci_curvature.OllivierRicciCurvature.calculate_ricci_↩
curvature (
              self,
              alpha = 0.5,
              norm = True )


Calculate nonzero values of Ricci curvature tensor for all edges in
graph self.G

Parameters
----------
alpha : float
    hyperparameter (0 <= alpha <=1) determining how much mass to move
    from node
norm : bool
    if True, normalize nodal scalar curvature

Returns
-------
self.G : networkx graph
    Returns graph with ricci_curvature as node and edge attributes
```

The documentation for this class was generated from the following file:

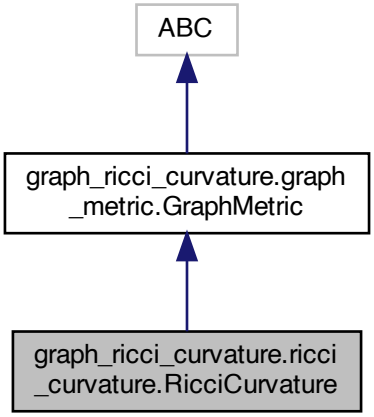
- graph_ricci_curvature/ollivier_ricci_curvature.py

## 5.3 graph_ricci_curvature.ricci_curvature.RicciCurvature Class Reference

Inheritance diagram for graph_ricci_curvature.ricci_curvature.RicciCurvature:




Collaboration diagram for graph_ricci_curvature.ricci_curvature.RicciCurvature:



## Public Member Functions

- def **__init__** (self, nx.Graph G, weight_key="weight")

## Additional Inherited Members

### 5.3.1 Detailed Description

```
Class for calculating Ollivier Ricci Curvature

Parameters
----------
G : networkx graph
    Input graph
weight_key : str
    key to specify edge weights in networkx dictionary. Default = weight
```

The documentation for this class was generated from the following file:

- graph_ricci_curvature/ricci_curvature.py

# Index