

---

# PyGraphistry Documentation

**Graphistry, Inc.**

**Dec 05, 2023**



# CONTENTS

<b>1</b>	<b>plotter</b>	<b>3</b>
1.1	Plotter Base . . . . .	3
1.2	Plotter Modules . . . . .	29
<b>2</b>	<b>Plugins</b>	<b>35</b>
2.1	iGraph . . . . .	35
2.2	CuGraph . . . . .	38
<b>3</b>	<b>Compute</b>	<b>41</b>
3.1	Compute Modules . . . . .	41
3.1.1	predicates module . . . . .	41
3.1.2	ASTPredicate . . . . .	41
3.1.3	categorical . . . . .	41
3.1.4	is_in . . . . .	41
3.1.5	numeric . . . . .	42
3.1.6	str . . . . .	43
3.1.7	temporal . . . . .	46
3.2	ComputeMixin module . . . . .	47
3.3	Chain . . . . .	50
3.4	Cluster . . . . .	52
3.5	Collapse . . . . .	56
3.6	Conditional . . . . .	60
3.7	Filter by Dictionary . . . . .	61
3.8	Hop . . . . .	61
3.9	predicates . . . . .	62
<b>4</b>	<b>Layouts</b>	<b>63</b>
4.1	edge Module . . . . .	63
4.2	edgeBase Module . . . . .	63
4.3	graph Module . . . . .	64
4.4	graphBase Module . . . . .	65
4.5	vertex Module . . . . .	66
4.6	vertexBase Module . . . . .	67
4.7	Module contents . . . . .	67
<b>5</b>	<b>Featurize</b>	<b>69</b>
<b>6</b>	<b>UMAP</b>	<b>87</b>
<b>7</b>	<b>Semantic Search</b>	<b>91</b>

<b>8 DBScan</b>	<b>93</b>
<b>9 Arrow uploader Module</b>	<b>99</b>
<b>10 Arrow File Uploader Module</b>	<b>103</b>
<b>11 Versioneer</b>	<b>105</b>
<b>12 Modules</b>	<b>107</b>
12.1 graphistry.plugins_types package . . . . .	107
12.1.1 graphistry.layout.utils package . . . . .	107
12.1.2 Submodules . . . . .	115
12.1.3 graphistry.plugins_types.cugraph_types module . . . . .	115
12.1.4 Module contents . . . . .	115
<b>13 Articles</b>	<b>117</b>
<b>14 Indices and tables</b>	<b>119</b>
<b>Index</b>	<b>121</b>

PyGraphistry is a Python visual graph AI library to extract, transform, analyze, model, and visualize big graphs, and especially alongside Graphistry end-to-end GPU server sessions. Installing optional graphistry[ai] dependencies adds graph autoML, including automatic feature engineering, UMAP, and graph neural net support. Combined, PyGraphistry reduces your time to graph for going from raw data to visualizations and AI models down to three lines of code. Here in our docstrings you can find useful packages, modules, and commands to maximize your graph AI experience with PyGraphistry. In the navbar you can find an overview of all the packages and modules we provided and a few useful highlighted ones as well. You can search for them on our Search page. For a full tutorial, refer to our [PyGraphistry repo](#).

For self-hosting and access to a free API key, refer to our Graphistry [Hub](#).



## 1.1 Plotter Base

**class** graphistry.PlotterBase.**PlotterBase** (\*args, \*\*kwargs)

Bases: graphistry.Plottable.Plottable

Graph plotting class.

Created using Graphistry.bind().

Chained calls successively add data and visual encodings, and end with a plot call.

To streamline reuse and replayable notebooks, Plotter manipulations are immutable. Each chained call returns a new instance that derives from the previous one. The old plotter or the new one can then be used to create different graphs.

When using memoization, for .register(api=3) sessions with .plot(memoize=True), Pandas/cudf arrow coercions are memoized, and file uploads are skipped on same-hash dataframes.

The class supports convenience methods for mixing calls across Pandas, NetworkX, and IGraph.

### Parameters

- **args** (Any) –
- **kwargs** (Any) –

**addStyle** (fg=None, bg=None, page=None, logo=None)

Set general visual styles

See .bind() and .settings(url\_params={}) for additional styling options, and style() for another way to set the same attributes.

To facilitate reuse and replayable notebooks, the addStyle() call is chainable. Invocation does not effect the old style: it instead returns a new Plotter instance with the new styles added to the existing ones. Both the old and new styles can then be used for different graphs.

addStyle() will extend the existing style settings, while style() will replace any in the same group

### Parameters

- **fg** (dict) – Dictionary {'blendMode': str} of any valid CSS blend mode
- **bg** (dict) – Nested dictionary of page background properties. {'color': str, 'gradient': {'kind': str, 'position': str, 'stops': list }, 'image': { 'url': str, 'width': int, 'height': int, 'blendMode': str }
- **logo** (dict) – Nested dictionary of logo properties. { 'url': str, 'autoInvert': bool, 'position': str, 'dimensions': { 'maxWidth': int, 'maxHeight': int }, 'crop': { 'top': int,

```
‘left’: int, ‘bottom’: int, ‘right’: int }, ‘padding’: { ‘top’: int, ‘left’: int, ‘bottom’: int,
‘right’: int}, ‘style’: str}
```

- **page** (*dict*) – Dictionary of page metadata settings. { ‘favicon’: str, ‘title’: str }

**Returns** Plotter

**Return type** Plotter

#### Example: Chained merge - results in color, blendMode, and url being set

```
g2 = g.addStyle(bg={'color': 'black'}, fg={'blendMode': 'screen'})
g3 = g2.addStyle(bg={'image': {'url': 'http://site.com/watermark.png'}})
```

#### Example: Overwrite - results in blendMode multiply

```
g2 = g.addStyle(fg={'blendMode': 'screen'})
g3 = g2.addStyle(fg={'blendMode': 'multiply'})
```

#### Example: Gradient background

```
g.addStyle(bg={'gradient': {'kind': 'linear', 'position': 45, 'stops': [[
↪ 'rgb(0,0,0)', '0%'], ['rgb(255,255,255)', '100%']]})
```

#### Example: Page settings

```
g.addStyle(page={'title': 'Site - {{ name }}', 'favicon': 'http://site.
↪com/logo.ico'})
```

**bind** (*source=None, destination=None, node=None, edge=None, edge\_title=None, edge\_label=None, edge\_color=None, edge\_weight=None, edge\_size=None, edge\_opacity=None, edge\_icon=None, edge\_source\_color=None, edge\_destination\_color=None, point\_title=None, point\_label=None, point\_color=None, point\_weight=None, point\_size=None, point\_opacity=None, point\_icon=None, point\_x=None, point\_y=None*)

Relate data attributes to graph structure and visual representation. To facilitate reuse and replayable notebooks, the binding call is chainable. Invocation does not effect the old binding: it instead returns a new Plotter instance with the new bindings added to the existing ones. Both the old and new bindings can then be used for different graphs.

#### Parameters

- **source** (*str*) – Attribute containing an edge’s source ID
- **destination** (*str*) – Attribute containing an edge’s destination ID
- **node** (*str*) – Attribute containing a node’s ID
- **edge** (*str*) – Attribute containing an edge’s ID
- **edge\_title** (*str*) – Attribute overriding edge’s minimized label text. By default, the edge source and destination is used.
- **edge\_label** (*str*) – Attribute overriding edge’s expanded label text. By default, scrollable list of attribute/value mappings.
- **edge\_color** (*str*) – Attribute overriding edge’s color. rgba (int64) or int32 palette index, see [palette](#) definitions for values. Based on Color Brewer.
- **edge\_source\_color** (*str*) – Attribute overriding edge’s source color if no `edge_color`, as an rgba int64 value.



- **edge\_destination\_color** (*str*) – Attribute overriding edge’s destination color if no `edge_color`, as an `rgba` int64 value.
- **edge\_weight** (*str*) – Attribute overriding edge weight. Default is 1. Advanced layout controls will relayout edges based on this value.
- **point\_title** (*str*) – Attribute overriding node’s minimized label text. By default, the node ID is used.
- **point\_label** (*str*) – Attribute overriding node’s expanded label text. By default, scrollable list of attribute/value mappings.
- **point\_color** (*str*) – Attribute overriding node’s `color.rgba` (int64) or int32 palette index, see [palette](#) definitions for values. Based on Color Brewer.
- **point\_size** (*str*) – Attribute overriding node’s size. By default, uses the node degree. The visualization will normalize point sizes and adjust dynamically using semantic zoom.
- **point\_x** (*str*) – Attribute overriding node’s initial x position. Combine with “.settings(url\_params={‘play’: 0})” to create a custom layout
- **point\_y** (*str*) – Attribute overriding node’s initial y position. Combine with “.settings(url\_params={‘play’: 0})” to create a custom layout

**Returns** Plotter

**Return type** Plotter

#### Example: Minimal

```
import graphistry
g = graphistry.bind()
g = g.bind(source='src', destination='dst')
```

#### Example: Node colors

```
import graphistry
g = graphistry.bind()
g = g.bind(source='src', destination='dst',
          node='id', point_color='color')
```

#### Example: Chaining

```
import graphistry
g = graphistry.bind(source='src', destination='dst', node='id')

g1 = g.bind(point_color='color1', point_size='size1')

g.bind(point_color='color1b')

g2a = g1.bind(point_color='color2a')
g2b = g1.bind(point_color='color2b', point_size='size2b')

g3a = g2a.bind(point_size='size3a')
g3b = g2b.bind(point_size='size3b')
```

In the above **Chaining** example, all bindings use `src/dst/id`. Colors and sizes bind to:

```
g: default/default
g1: color1/size1
g2a: color2a/size1
```

(continues on next page)

(continued from previous page)

```
g2b: color2b/size2b
g3a: color2a/size3a
g3b: color2b/size3b
```

**bolt** (*driver*)**compute\_cugraph** (*alg*, *out\_col=None*, *params={}*, *kind='Graph'*, *directed=True*, *G=None*)

Run cugraph algorithm on graph. For algorithm parameters, see cuGraph docs.

**Parameters**

- **alg** (*str*) – algorithm name
- **out\_col** (*Optional[str]*) – node table output column name, defaults to alg param
- **params** (*dict*) – algorithm parameters passed to cuGraph as kwargs
- **kind** (*CuGraphKind*) – kind of cugraph to use
- **directed** (*bool*) – whether graph is directed
- **G** (*Optional[cugraph.Graph]*) – cugraph graph to use; if None, use self

**Returns** Plottable**Return type** Plottable**Example: Pagerank**

```
g2 = g.compute_cugraph('pagerank')
assert 'pagerank' in g2._nodes.columns
```

**Example: Katz centrality with rename**

```
g2 = g.compute_cugraph('katz_centrality', out_col='katz_centrality_renamed
↪')
assert 'katz_centrality_renamed' in g2._nodes.columns
```

**Example: Pass params to cugraph**

```
g2 = g.compute_cugraph('k_truss', params={'k': 2})
assert 'k_truss' in g2._nodes.columns
```

**compute\_igraph** (*alg*, *out\_col=None*, *directed=None*, *use\_vids=False*, *params={}*, *stringify\_rich\_types=True*)

Enrich or replace graph using igraph methods

**Parameters**

- **alg** (*str*) – Name of an igraph.Graph method like *pagerank*
- **out\_col** (*Optional[str]*) – For algorithms that generate a node attribute column, *out\_col* is the desired output column name. When *None*, use the algorithm's name. (default *None*)
- **directed** (*Optional[bool]*) – During the to\_igraph conversion, whether to be directed. If *None*, try directed and then undirected. (default *None*)
- **use\_vids** (*bool*) – During the to\_igraph conversion, whether to interpret IDs as igraph vertex IDs (non-negative integers) or arbitrary values (*False*, default)
- **params** (*dict*) – Any named parameters to pass to the underlying igraph method

- **stringify\_rich\_types** (*bool*) – When rich types like `igraph.Graph` are returned, which may be problematic for downstream rendering, coerce them to strings

**Returns** Plotter

**Return type** Plotter

#### Example: Pagerank

```
import graphistry, pandas as pd
edges = pd.DataFrame({'s': ['a', 'b', 'c', 'd'], 'd': ['c', 'c', 'e', 'e']})
g = graphistry.edges(edges, 's', 'd')
g2 = g.compute_igraph('pagerank')
assert 'pagerank' in g2._nodes.columns
```

#### Example: Pagerank with custom name

```
import graphistry, pandas as pd
edges = pd.DataFrame({'s': ['a', 'b', 'c', 'd'], 'd': ['c', 'c', 'e', 'e']})
g = graphistry.edges(edges, 's', 'd')
g2 = g.compute_igraph('pagerank', out_col='my_pr')
assert 'my_pr' in g2._nodes.columns
```

#### Example: Pagerank on an undirected

```
import graphistry, pandas as pd
edges = pd.DataFrame({'s': ['a', 'b', 'c', 'd'], 'd': ['c', 'c', 'e', 'e']})
g = graphistry.edges(edges, 's', 'd')
g2 = g.compute_igraph('pagerank', directed=False)
assert 'pagerank' in g2._nodes.columns
```

#### Example: Pagerank with custom parameters

```
import graphistry, pandas as pd
edges = pd.DataFrame({'s': ['a', 'b', 'c', 'd'], 'd': ['c', 'c', 'e', 'e']})
g = graphistry.edges(edges, 's', 'd')
g2 = g.compute_igraph('pagerank', params={'damping': 0.85})
assert 'pagerank' in g2._nodes.columns
```

**copy** ()

**Return type** Plottable

**cypher** (*query*, *params*={})

**description** (*description*)

Upload description

**Parameters** **description** (*str*) – Upload description

**edges** (*edges*, *source*=None, *destination*=None, *edge*=None, *\*args*, *\*\*kwargs*)

Specify edge list data and associated edge attribute values. If a callable, will be called with current Plotter and whatever positional+named arguments

**Parameters** **edges** (*Pandas dataframe*, *NetworkX graph*, or *IGraph graph*) – Edges and their attributes, or transform from Plotter to edges

**Returns** Plotter

**Return type** Plotter

**Example**

```
import graphistry
df = pandas.DataFrame({'src': [0,1,2], 'dst': [1,2,0]})
graphistry
    .bind(source='src', destination='dst')
    .edges(df)
    .plot()
```

**Example**

```
import graphistry
df = pandas.DataFrame({'src': [0,1,2], 'dst': [1,2,0], 'id': [0, 1, 2]})
graphistry
    .bind(source='src', destination='dst', edge='id')
    .edges(df)
    .plot()
```

**Example**

```
import graphistry
df = pandas.DataFrame({'src': [0,1,2], 'dst': [1,2,0]})
graphistry
    .edges(df, 'src', 'dst')
    .plot()
```

**Example**

```
import graphistry
df = pandas.DataFrame({'src': [0,1,2], 'dst': [1,2,0], 'id': [0, 1, 2]})
graphistry
    .edges(df, 'src', 'dst', 'id')
    .plot()
```

**Example**

```
import graphistry

def sample_edges(g, n):
    return g._edges.sample(n)

df = pandas.DataFrame({'src': [0,1,2], 'dst': [1,2,0]})

graphistry
    .edges(df, 'src', 'dst')
    .edges(sample_edges, n=2)
    .edges(sample_edges, None, None, None, 2) # equivalent
    .plot()
```

**encode\_axis** (rows=[])

Render radial and linear axes with optional labels

**Parameters** **rows** – List of rows - { label: Optional[str],?r: float, ?x: float, ?y: float, ?internal: true, ?external: true, ?space: true }**Returns** Plotter**Return type** Plotter

**Example: Several radial axes**

```
g.encode_axis([
  {'r': 14, 'external': True, 'label': 'outermost'},
  {'r': 12, 'external': True},
  {'r': 10, 'space': True},
  {'r': 8, 'space': True},
  {'r': 6, 'internal': True},
  {'r': 4, 'space': True},
  {'r': 2, 'space': True, 'label': 'innermost'}
])
```

**Example: Several horizontal axes**

```
g.encode_axis([
  {"label": "a", "y": 2, "internal": True },
  {"label": "b", "y": 40, "external": True, "width": 20, "bounds": {"min
↪": 40, "max": 400}},
])
```

**encode\_edge\_badge** (*column*, *position*='TopRight', *categorical\_mapping*=None, *continuous\_binning*=None, *default\_mapping*=None, *comparator*=None, *color*=None, *bg*=None, *fg*=None, *for\_current*=False, *for\_default*=True, *as\_text*=None, *blend\_mode*=None, *style*=None, *border*=None, *shape*=None)

**encode\_edge\_color** (*column*, *palette*=None, *as\_categorical*=None, *as\_continuous*=None, *categorical\_mapping*=None, *default\_mapping*=None, *for\_default*=True, *for\_current*=False)

Set edge color with more control than bind()

**Parameters**

- **column** (*str*) – Data column name
- **palette** (*Optional[list]*) – Optional list of color-like strings. Ex: ["black", "#FF0", "rgb(255,255,255)"]. Used as a gradient for continuous and round-robin for categorical.
- **as\_categorical** (*Optional[bool]*) – Interpret column values as categorical. Ex: Uses palette via round-robin when more values than palette entries.
- **as\_continuous** (*Optional[bool]*) – Interpret column values as continuous. Ex: Uses palette for an interpolation gradient when more values than palette entries.
- **categorical\_mapping** (*Optional[dict]*) – Mapping from column values to color-like strings. Ex: {"car": "red", "truck": "#000"}
- **default\_mapping** (*Optional[str]*) – Augment categorical\_mapping with mapping for values not in categorical\_mapping. Ex: default\_mapping="gray".
- **for\_default** (*Optional[bool]*) – Use encoding for when no user override is set. Default on.
- **for\_current** (*Optional[bool]*) – Use encoding as currently active. Clearing the active encoding resets it to default, which may be different. Default on.

**Returns** Plotter

**Return type** Plotter

**Example:** See `encode_point_color`

**encode\_edge\_icon** (*column*, *categorical\_mapping=None*, *continuous\_binning=None*, *default\_mapping=None*, *comparator=None*, *for\_default=True*, *for\_current=False*, *as\_text=False*, *blend\_mode=None*, *style=None*, *border=None*, *shape=None*)

Set edge icon with more control than `bind()`. Values from Font Awesome 4 such as “laptop”: <https://fontawesome.com/v4.7.0/icons/>, image URLs (<http://...>), and data URIs (`data:...`). When `as_text=True` is enabled, values are instead interpreted as raw strings.

#### Parameters

- **column** (*str*) – Data column name
- **categorical\_mapping** (*Optional[dict]*) – Mapping from column values to icon name strings. Ex: {“toyota”: ‘car’, “ford”: ‘truck’}
- **default\_mapping** (*Optional[Union[int, float]]*) – Augment categorical\_mapping with mapping for values not in categorical\_mapping. Ex: `default_mapping=50`.
- **for\_default** (*Optional[bool]*) – Use encoding for when no user override is set. Default on.
- **for\_current** (*Optional[bool]*) – Use encoding as currently active. Clearing the active encoding resets it to default, which may be different. Default on.
- **as\_text** (*Optional[bool]*) – Values should instead be treated as raw strings, instead of icons and images. (Default False.)

**Returns** Plotter

**Return type** Plotter

**Example: Set a string column of icons for the edge icons, same as `bind(edge_icon='my_column')`**

```
g2a = g.encode_edge_icon('my_icons_column')
```

**Example: Map specific values to specific icons, including with a default**

```
g2a = g.encode_edge_icon('brands', categorical_mapping={'toyota': 'car',
↳ 'ford': 'truck'})
g2b = g.encode_edge_icon('brands', categorical_mapping={'toyota': 'car',
↳ 'ford': 'truck'}, default_mapping='question')
```

**Example: Map countries to abbreviations**

```
g2a = g.encode_edge_icon('country_abbrev', as_text=True)
g2b = g.encode_edge_icon('country', as_text=True, categorical_mapping={
↳ 'England': 'UK', 'America': 'US'}, default_mapping='')
```

**Example: Border**

```
g2b = g.encode_edge_icon('country', border={'width': 3, color: 'black',
↳ 'stroke': 'dashed'}, 'categorical_mapping={'England': 'UK', 'America':
↳ 'US'})
```

**encode\_point\_badge** (*column*, *position='TopRight'*, *categorical\_mapping=None*, *continuous\_binning=None*, *default\_mapping=None*, *comparator=None*, *color=None*, *bg=None*, *fg=None*, *for\_current=False*, *for\_default=True*, *as\_text=None*, *blend\_mode=None*, *style=None*, *border=None*, *shape=None*)

**encode\_point\_color** (*column, palette=None, as\_categorical=None, as\_continuous=None, categorical\_mapping=None, default\_mapping=None, for\_default=True, for\_current=False*)

Set point color with more control than bind()

#### Parameters

- **column** (*str*) – Data column name
- **palette** (*Optional[list]*) – Optional list of color-like strings. Ex: ["black", "#FF0", "rgb(255,255,255)"]. Used as a gradient for continuous and round-robin for categorical.
- **as\_categorical** (*Optional[bool]*) – Interpret column values as categorical. Ex: Uses palette via round-robin when more values than palette entries.
- **as\_continuous** (*Optional[bool]*) – Interpret column values as continuous. Ex: Uses palette for an interpolation gradient when more values than palette entries.
- **categorical\_mapping** (*Optional[dict]*) – Mapping from column values to color-like strings. Ex: {"car": "red", "truck": "#000"}
- **default\_mapping** (*Optional[str]*) – Augment categorical\_mapping with mapping for values not in categorical\_mapping. Ex: default\_mapping="gray".
- **for\_default** (*Optional[bool]*) – Use encoding for when no user override is set. Default on.
- **for\_current** (*Optional[bool]*) – Use encoding as currently active. Clearing the active encoding resets it to default, which may be different. Default on.

**Returns** Plotter

**Return type** Plotter

**Example: Set a palette-valued column for the color, same as bind(point\_color='my\_column')**

```
g2a = g.encode_point_color('my_int32_palette_column')
g2b = g.encode_point_color('my_int64_rgb_column')
```

**Example: Set a cold-to-hot gradient of along the spectrum blue, yellow, red**

```
g2 = g.encode_point_color('my_numeric_col', palette=["blue", "yellow",
↪ "red"], as_continuous=True)
```

**Example: Round-robin sample from 5 colors in hex format**

```
g2 = g.encode_point_color('my_distinctly_valued_col', palette=["#000", "
↪ #00F", "#0F0", "#0FF", "#FFF"], as_categorical=True)
```

**Example: Map specific values to specific colors, including with a default**

```
g2a = g.encode_point_color('brands', categorical_mapping={'toyota': 'red',
↪ 'ford': 'blue'})
g2a = g.encode_point_color('brands', categorical_mapping={'toyota': 'red',
↪ 'ford': 'blue'}, default_mapping='gray')
```

**encode\_point\_icon** (*column, categorical\_mapping=None, continuous\_binning=None, default\_mapping=None, comparator=None, for\_default=True, for\_current=False, as\_text=False, blend\_mode=None, style=None, border=None, shape=None*)

Set node icon with more control than bind(). Values from Font Awesome 4 such as “laptop”: <https://fontawesome.com/icons/laptop>

`//fontawesome.com/v4.7.0/icons/`, image URLs (`http://...`), and data URIs (`data:...`). When `as_text=True` is enabled, values are instead interpreted as raw strings.

### Parameters

- **column** (*str*) – Data column name
- **categorical\_mapping** (*Optional[dict]*) – Mapping from column values to icon name strings. Ex: `{“toyota”: ‘car’, “ford”: ‘truck’}`
- **default\_mapping** (*Optional[Union[int, float]]*) – Augment categorical\_mapping with mapping for values not in categorical\_mapping. Ex: `default_mapping=50`.
- **for\_default** (*Optional[bool]*) – Use encoding for when no user override is set. Default on.
- **for\_current** (*Optional[bool]*) – Use encoding as currently active. Clearing the active encoding resets it to default, which may be different. Default on.
- **as\_text** (*Optional[bool]*) – Values should instead be treated as raw strings, instead of icons and images. (Default False.)
- **blend\_mode** (*Optional[str]*) – CSS blend mode
- **style** (*Optional[dict]*) – CSS filter properties - opacity, saturation, luminosity, grayscale, and more
- **border** (*Optional[dict]*) – Border properties - ‘width’, ‘color’, and ‘stroke’

**Returns** Plotter

**Return type** Plotter

**Example: Set a string column of icons for the point icons, same as `bind(point_icon='my_column')`**

```
g2a = g.encode_point_icon('my_icons_column')
```

**Example: Map specific values to specific icons, including with a default**

```
g2a = g.encode_point_icon('brands', categorical_mapping={'toyota': 'car',
↳ 'ford': 'truck'})
g2b = g.encode_point_icon('brands', categorical_mapping={'toyota': 'car',
↳ 'ford': 'truck'}, default_mapping='question')
```

**Example: Map countries to abbreviations**

```
g2b = g.encode_point_icon('country_abbrev', as_text=True)
g2b = g.encode_point_icon('country', as_text=True, categorical_mapping={
↳ 'England': 'UK', 'America': 'US'}, default_mapping='')
```

**Example: Border**

```
g2b = g.encode_point_icon('country', border={'width': 3, color: 'black',
↳ 'stroke': 'dashed'}, categorical_mapping={'England': 'UK', 'America':
↳ 'US'})
```

**encode\_point\_size** (*column, categorical\_mapping=None, default\_mapping=None,*

*for\_default=True, for\_current=False*)

Set point size with more control than `bind()`

### Parameters



- **column** (*str*) – Data column name
- **categorical\_mapping** (*Optional[dict]*) – Mapping from column values to numbers. Ex: {"car": 100, "truck": 200}
- **default\_mapping** (*Optional[Union[int, float]]*) – Augment categorical\_mapping with mapping for values not in categorical\_mapping. Ex: default\_mapping=50.
- **for\_default** (*Optional[bool]*) – Use encoding for when no user override is set. Default on.
- **for\_current** (*Optional[bool]*) – Use encoding as currently active. Clearing the active encoding resets it to default, which may be different. Default on.

**Returns** Plotter

**Return type** Plotter

**Example: Set a numerically-valued column for the size, same as bind(point\_size='my\_column')**

```
g2a = g.encode_point_size('my_numeric_column')
```

**Example: Map specific values to specific colors, including with a default**

```
g2a = g.encode_point_size('brands', categorical_mapping={'toyota': 100,
↪ 'ford': 200})
g2b = g.encode_point_size('brands', categorical_mapping={'toyota': 100,
↪ 'ford': 200}, default_mapping=50)
```

**from\_cugraph** (*G*, *node\_attributes=None*, *edge\_attributes=None*, *load\_nodes=True*,  
*load\_edges=True*, *merge\_if\_existing=True*)

If bound IDs, use the same IDs in the returned graph.

If non-empty nodes/edges, instead of returning *G*'s topology, use existing topology and merge in *G*'s attributes

#### Parameters

- **node\_attributes** (*Optional[List[str]]*) –
- **edge\_attributes** (*Optional[List[str]]*) –
- **load\_nodes** (*bool*) –
- **load\_edges** (*bool*) –
- **merge\_if\_existing** (*bool*) –

**from\_igraph** (*ig*, *node\_attributes=None*, *edge\_attributes=None*, *load\_nodes=True*, *load\_edges=True*,  
*merge\_if\_existing=True*)

Convert *igraph* object into Plotter

If base *g* has *\_node*, *\_source*, *\_destination* definitions, use them

When *merge\_if\_existing* with preexisting nodes/edges *df* and *shapes* match *ig*, combine attributes

For *merge\_if\_existing* to work with edges, must set *g.\_edge* and have corresponding edge index attribute in *igraph.Graph*

#### Parameters

- **ig** (*igraph*) – Source *igraph* object

- **node\_attributes** (*Optional[List[str]*) – Subset of node attributes to load; None means all (default)
- **edge\_attributes** (*Optional[List[str]*) – Subset of edge attributes to load; None means all (default)
- **load\_nodes** (*bool*) – Whether to load nodes dataframe (default True)
- **load\_edges** (*bool*) – Whether to load edges dataframe (default True)
- **merge\_if\_existing** – Whether to merge with existing node/edge dataframes (default True)
- **merge\_if\_existing** – bool

**Returns** Plotter

#### Example: Convert from igraph, including all node/edge properties

```
import graphistry, pandas as pd
edges = pd.DataFrame({'s': ['a', 'b', 'c', 'd'], 'd': ['b', 'c', 'd', 'e
↔'], 'v': [101, 102, 103, 104]})
g = graphistry.edges(edges, 's', 'd').materialize_nodes().get_degrees()
assert 'degree' in g._nodes.columns
g2 = g.from_igraph(g.to_igraph())
assert len(g2._nodes.columns) == len(g._nodes.columns)
```

#### Example: Enrich from igraph, but only load in 1 node attribute

```
import graphistry, pandas as pd
edges = pd.DataFrame({'s': ['a', 'b', 'c', 'd'], 'd': ['b', 'c', 'd', 'e
↔'], 'v': [101, 102, 103, 104]})
g = graphistry.edges(edges, 's', 'd').materialize_nodes().get_degree()
assert 'degree' in g._nodes
ig = g.to_igraph(include_nodes=False)
assert 'degree' not in ig.vs
ig.vs['pagerank'] = ig.pagerank()
g2 = g.from_igraph(ig, load_edges=False, node_attributes=[g._node,
↔'pagerank'])
assert 'pagerank' in g2._nodes
assert 'degree' in g2._nodes
```

#### **graph** (*ig*)

Specify the node and edge data.

**Parameters** **ig** (*Any*) – NetworkX graph or an IGraph graph with node and edge attributes.

**Returns** Plotter

**Return type** Plotter

#### **gsq1** (*query, bindings={}, dry\_run=False*)

Run Tigergraph query in interpreted mode and return transformed Plottable

**param query** Code to run

**type query** str

**param bindings** Mapping defining names of returned ‘edges’ and/or ‘nodes’, defaults to @@nodeList and @@edgeList

**type bindings** Optional[dict]

**param dry\_run** Return target URL without running

**type dry\_run** bool

**returns** Plotter

**rtype** Plotter

### Example: Minimal

```
import graphistry
tg = graphistry.tigergraph()
tg.gsql("""
INTERPRET QUERY () FOR GRAPH Storage {

    OrAccum<BOOL> @@stop;
    ListAccum<EDGE> @@edgeList;
    SetAccum<vertex> @@set;

    @@set += to_vertex("61921", "Pool");

    Start = @@set;

    while Start.size() > 0 and @@stop == false do

        Start = select t from Start:s-(:e)-:t
        where e.goUpper == TRUE
        accum @@edgeList += e
        having t.type != "Service";
    end;

    print @@edgeList;
}
""").plot()
```

### Example: Full

```
import graphistry
tg = graphistry.tigergraph()
tg.gsql("""
INTERPRET QUERY () FOR GRAPH Storage {

    OrAccum<BOOL> @@stop;
    ListAccum<EDGE> @@edgeList;
    SetAccum<vertex> @@set;

    @@set += to_vertex("61921", "Pool");

    Start = @@set;

    while Start.size() > 0 and @@stop == false do

        Start = select t from Start:s-(:e)-:t
        where e.goUpper == TRUE
        accum @@edgeList += e
        having t.type != "Service";
    end;
```

(continues on next page)

(continued from previous page)

```

    print @@my_edge_list;
}
"""', {'edges': 'my_edge_list'}).plot()

```

**gsql\_endpoint** (*method\_name*, *args={}*, *bindings={}*, *db=None*, *dry\_run=False*)

Invoke Tigergraph stored procedure at a user-definend endpoint and return transformed Plottable

#### Parameters

- **method\_name** (*str*) – Stored procedure name
- **args** (*Optional[dict]*) – Named endpoint arguments
- **bindings** (*Optional[dict]*) – Mapping defining names of returned ‘edges’ and/or ‘nodes’, defaults to @@nodeList and @@edgeList
- **db** (*Optional[str]*) – Name of the database, defaults to value set in .tigergraph(...)
- **dry\_run** (*bool*) – Return target URL without running

**Returns** Plotter

**Return type** Plotter

#### Example: Minimal

```

import graphistry
tg = graphistry.tigergraph(db='my_db')
tg.gsql_endpoint('neighbors').plot()

```

#### Example: Full

```

import graphistry
tg = graphistry.tigergraph()
tg.gsql_endpoint('neighbors', {'k': 2}, {'edges': 'my_edge_list'}, 'my_db
→').plot()

```

#### Example: Read data

```

import graphistry
tg = graphistry.tigergraph()
out = tg.gsql_endpoint('neighbors')
(nodes_df, edges_df) = (out._nodes, out._edges)

```

**hypergraph** (*raw\_events*, *entity\_types=None*, *opts={}*, *drop\_na=True*, *drop\_edge\_attrs=False*, *verbose=True*, *direct=False*, *engine='pandas'*, *npartitions=None*, *chunksize=None*)

Transform a dataframe into a hypergraph.

#### Parameters

- **raw\_events** (*pandas.DataFrame*) – Dataframe to transform (pandas or cudf).
- **entity\_types** (*Optional[list]*) – Columns (strings) to turn into nodes, None signifies all
- **opts** (*dict*) – See below
- **drop\_edge\_attrs** (*bool*) – Whether to include each row’s attributes on its edges, defaults to False (include)
- **verbose** (*bool*) – Whether to print size information

- **direct** (*bool*) – Omit hypernode and instead strongly connect nodes in an event
- **engine** (*bool*) – String (pandas, cudf, ...) for engine to use
- **npartitions** (*Optional[int]*) – For distributed engines, how many coarse-grained pieces to split events into
- **chunksize** (*Optional[int]*) – For distributed engines, split events after chunksize rows

Create a graph out of the dataframe, and return the graph components as dataframes, and the renderable result Plotter. Hypergraphs reveal relationships between rows and between column values. This transform is useful for lists of events, samples, relationships, and other structured high-dimensional data.

Specify local compute engine by passing `engine='pandas'`, `'cudf'`, `'dask'`, `'dask_cudf'` (default: `'pandas'`). If events are not in that engine's format, they will be converted into it.

The transform creates a node for every unique value in the `entity_types` columns (default: all columns). If `direct=False` (default), every row is also turned into a node. Edges are added to connect every table cell to its originating row's node, or if `direct=True`, to the other nodes from the same row. Nodes are given the attribute `'type'` corresponding to the originating column name, or in the case of a row, `'EventID'`. Options further control the transform, such column category definitions for controlling whether values recurring in different columns should be treated as one node, or whether to only draw edges between certain column type pairs.

Consider a list of events. Each row represents a distinct event, and each column some metadata about an event. If multiple events have common metadata, they will be transitively connected through those metadata values. The layout algorithm will try to cluster the events together. Conversely, if an event has unique metadata, the unique metadata will turn into nodes that only have connections to the event node, and the clustering algorithm will cause them to form a ring around the event node.

Best practice is to set `EVENTID` to a row's unique ID, `SKIP` to all non-categorical columns (or `entity_types` to all categorical columns), and `CATEGORY` to group columns with the same kinds of values.

To prevent creating nodes for null values, set `drop_na=True`. Some dataframe engines may have undesirable null handling, and recommend replacing `None` values with `np.nan`.

The optional `opts={...}` configuration options are:

- `'EVENTID'`: Column name to inspect for a row ID. By default, uses the row index.
- `'CATEGORIES'`: Dictionary mapping a category name to inhabiting columns. E.g., `{'IP': ['srcAddress', 'dstAddress']}`. If the same IP appears in both columns, this makes the transform generate one node for it, instead of one for each column.
- `'DELIM'`: When creating node IDs, defines the separator used between the column name and node value
- `'SKIP'`: List of column names to not turn into nodes. For example, dates and numbers are often skipped.
- `'EDGES'`: For `direct=True`, instead of making all edges, pick column pairs. E.g., `{'a': ['b', 'd'], 'd': ['d']}` creates edges between columns `a->b` and `a->d`, and self-edges `d->d`.

**Returns** `{'entities': DF, 'events': DF, 'edges': DF, 'nodes': DF, 'graph': Plotter}`

**Return type** `dict`

**Example: Connect user<-row->boss**

```
import graphistry
users_df = pd.DataFrame({'user': ['a','b','x'], 'boss': ['x', 'x', 'y']})
h = graphistry.hypergraph(users_df)
g = h['graph'].plot()
```

**Example: Connect user->boss**

```
import graphistry
users_df = pd.DataFrame({'user': ['a','b','x'], 'boss': ['x', 'x', 'y']})
h = graphistry.hypergraph(users_df, direct=True)
g = h['graph'].plot()
```

**Example: Connect user<->boss**

```
import graphistry
users_df = pd.DataFrame({'user': ['a','b','x'], 'boss': ['x', 'x', 'y']})
h = graphistry.hypergraph(users_df, direct=True, opts={'EDGES': {'user': ['boss'], 'boss': ['user']}})
g = h['graph'].plot()
```

**Example: Only consider some columns for nodes**

```
import graphistry
users_df = pd.DataFrame({'user': ['a','b','x'], 'boss': ['x', 'x', 'y']})
h = graphistry.hypergraph(users_df, entity_types=['boss'])
g = h['graph'].plot()
```

**Example: Collapse matching user::<id> and boss::<id> nodes into one person::<id> node**

```
import graphistry
users_df = pd.DataFrame({'user': ['a','b','x'], 'boss': ['x', 'x', 'y']})
h = graphistry.hypergraph(users_df, opts={'CATEGORIES': {'person': ['user', 'boss']}})
g = h['graph'].plot()
```

**Example: Use cudf engine instead of pandas**

```
import cudf, graphistry
users_gdf = cudf.DataFrame({'user': ['a','b','x'], 'boss': ['x', 'x', 'y']})
h = graphistry.hypergraph(users_gdf, engine='cudf')
g = h['graph'].plot()
```

**Parameters**

- **entity\_types** (Optional[List[str]]) –
- **opts** (dict) –
- **drop\_na** (bool) –
- **drop\_edge\_attrs** (bool) –
- **verbose** (bool) –

- **direct** (*bool*) –
- **engine** (*str*) –
- **npartitions** (*Optional[int]*) –
- **chunksize** (*Optional[int]*) –

### **igraph2pandas** (*ig*)

Under current bindings, transform an IGraph into a pandas edges dataframe and a nodes dataframe.

Deprecated in favor of `.from_igraph()`

#### **Example**

```
import graphistry
g = graphistry.bind()

es = pandas.DataFrame({'src': [0,1,2], 'dst': [1,2,0]})
g = g.bind(source='src', destination='dst').edges(es)

ig = g.pandas2igraph(es)
ig.vs['community'] = ig.community_infomap().membership

(es2, vs2) = g.igraph2pandas(ig)
g.nodes(vs2).bind(point_color='community').plot()
```

### **infer\_labels** ()

**Returns** Plotter w/neo4j

- Prefers `point_title/point_label` if available
- Fallback to node id
- Raises exception if no nodes available, no likely candidates, and no matching node id fallback

#### **Example**

```
import graphistry
g = graphistry.nodes(pd.read_csv('nodes.csv'), 'id_col').infer_labels()
g.plot()
```

### **layout\_cugraph** (*layout='force\_atlas2', params={}, kind='Graph', directed=True, G=None, bind\_position=True, x\_out\_col='x', y\_out\_col='y', play=0*)

Layout the graph using a cuGraph algorithm. For a list of layouts, see `cugraph` documentation (currently just `force_atlas2`).

#### **Parameters**

- **layout** (*str*) – Name of an `cugraph` layout method like `force_atlas2`
- **params** (*dict*) – Any named parameters to pass to the underlying `cugraph` method
- **kind** (*CuGraphKind*) – The kind of `cugraph` Graph
- **directed** (*bool*) – During the `to_cugraph` conversion, whether to be directed. (default `True`)
- **G** (*Optional[Any]*) – The `cugraph` graph (`G`) to layout. If `None`, the current graph is used.
- **bind\_position** (*bool*) – Whether to call `bind(point_x=, point_y=)` (default `True`)

- **x\_out\_col** (*str*) – Attribute to write x position to. (default ‘x’)
- **y\_out\_col** (*str*) – Attribute to write x position to. (default ‘y’)
- **play** (*Optional[str]*) – If defined, set settings(url\_params={‘play’: play}). (default 0)

**Returns** Plotter

**Return type** Plotter

#### Example: ForceAtlas2 layout

```
import graphistry, pandas as pd
edges = pd.DataFrame({'s': ['a', 'b', 'c', 'd'], 'd': ['b', 'c', 'd', 'e']})
g = graphistry.edges(edges, 's', 'd')
g.layout_cugraph().plot()
```

#### Example: Change which column names are generated

```
import graphistry, pandas as pd
edges = pd.DataFrame({'s': ['a', 'b', 'c', 'd'], 'd': ['b', 'c', 'd', 'e']})
g = graphistry.edges(edges, 's', 'd')
g2 = g.layout_cugraph('force_atlas2', x_out_col='my_x', y_out_col='my_y')
assert 'my_x' in g2._nodes
assert g2._point_x == 'my_x'
g2.plot()
```

#### Example: Pass parameters to layout methods

```
import graphistry, pandas as pd
edges = pd.DataFrame({'s': ['a', 'b', 'c', 'd'], 'd': ['b', 'c', 'd', 'e']})
g = graphistry.edges(edges, 's', 'd')
g2 = g.layout_cugraph('forceatlas_2', params={'lin_log_mode': True,
↵ 'prevent_overlapping': True})
g2.plot()
```

**layout\_igraph** (*layout*, *directed=None*, *use\_vids=False*, *bind\_position=True*, *x\_out\_col='x'*, *y\_out\_col='y'*, *play=0*, *params={}*)

Compute graph layout using igraph algorithm. For a list of layouts, see layout\_algs or igraph documentation.

#### Parameters

- **layout** (*str*) – Name of an igraph.Graph.layout method like *sugiyama*
- **directed** (*Optional[bool]*) – During the to\_igraph conversion, whether to be directed. If None, try directed and then undirected. (default None)
- **use\_vids** (*bool*) – Whether to use igraph vertex ids (non-negative integers) or arbitrary node ids (False, default)
- **bind\_position** (*bool*) – Whether to call bind(point\_x=, point\_y=) (default True)
- **x\_out\_col** (*str*) – Attribute to write x position to. (default ‘x’)
- **y\_out\_col** (*str*) – Attribute to write x position to. (default ‘y’)
- **play** (*Optional[str]*) – If defined, set settings(url\_params={‘play’: play}). (default 0)
- **params** (*dict*) – Any named parameters to pass to the underlying igraph method



**Returns** Plotter

**Return type** Plotter

### Example: Sugiyama layout

```
import graphistry, pandas as pd
edges = pd.DataFrame({'s': ['a', 'b', 'c', 'd'], 'd': ['b', 'c', 'd', 'e']})
g = graphistry.edges(edges, 's', 'd')
g2 = g.layout_igraph('sugiyama')
assert 'x' in g2._nodes
g2.plot()
```

### Example: Change which column names are generated

```
import graphistry, pandas as pd
edges = pd.DataFrame({'s': ['a', 'b', 'c', 'd'], 'd': ['b', 'c', 'd', 'e']})
g = graphistry.edges(edges, 's', 'd')
g2 = g.layout_igraph('sugiyama', x_out_col='my_x', y_out_col='my_y')
assert 'my_x' in g2._nodes
assert g2._point_x == 'my_x'
g2.plot()
```

### Example: Pass parameters to layout methods - Sort nodes by degree

```
import graphistry, pandas as pd
edges = pd.DataFrame({'s': ['a', 'b', 'c', 'd'], 'd': ['b', 'c', 'd', 'e']})
g = graphistry.edges(edges, 's', 'd')
g2 = g.get_degrees()
assert 'degree' in g._nodes.columns
g3 = g.layout_igraph('sugiyama', params={'layers': 'degree'})
g3.plot()
```

**layout\_settings** (*play=None, locked\_x=None, locked\_y=None, locked\_r=None, left=None, top=None, right=None, bottom=None, lin\_log=None, strong\_gravity=None, dissuade\_hubs=None, edge\_influence=None, precision\_vs\_speed=None, gravity=None, scaling\_ratio=None*)

Set layout options. Additive over previous settings.

Corresponds to options at <https://hub.graphistry.com/docs/api/1/rest/url/#urloptions>

### Example: Animated radial layout

```
import graphistry, pandas as pd
edges = pd.DataFrame({'s': ['a', 'b', 'c', 'd'], 'boss': ['c', 'c', 'e', 'e', '↔']})
nodes = pd.DataFrame({
    'n': ['a', 'b', 'c', 'd', 'e'],
    'y': [1, 1, 2, 3, 4],
    'x': [1, 1, 0, 0, 0],
})
g = (graphistry
     .edges(edges, 's', 'd')
     .nodes(nodes, 'n')
     .layout_settings(locked_r=True, play=2000)
g.plot()
```

### Parameters

- **play** (Optional[int]) –
- **locked\_x** (Optional[bool]) –
- **locked\_y** (Optional[bool]) –
- **locked\_r** (Optional[bool]) –
- **left** (Optional[float]) –
- **top** (Optional[float]) –
- **right** (Optional[float]) –
- **bottom** (Optional[float]) –
- **lin\_log** (Optional[bool]) –
- **strong\_gravity** (Optional[bool]) –
- **dissuade\_hubs** (Optional[bool]) –
- **edge\_influence** (Optional[float]) –
- **precision\_vs\_speed** (Optional[float]) –
- **gravity** (Optional[float]) –
- **scaling\_ratio** (Optional[float]) –

**name** (*name*)  
Upload name

**Parameters** **name** (*str*) – Upload name

**networkx2pandas** (*g*)

**networkx\_checkoverlap** (*g*)

**nodes** (*nodes*, *node=None*, *\*args*, *\*\*kwargs*)

Specify the set of nodes and associated data. If a callable, will be called with current Plotter and whatever positional+named arguments

Must include any nodes referenced in the edge list.

**Parameters** **nodes** (*Pandas dataframe or Callable*) – Nodes and their attributes.

**Returns** Plotter

**Return type** Plotter

### Example

```
import graphistry

es = pandas.DataFrame({'src': [0,1,2], 'dst': [1,2,0]})
g = graphistry
    .bind(source='src', destination='dst')
    .edges(es)

vs = pandas.DataFrame({'v': [0,1,2], 'lbl': ['a', 'b', 'c']})
g = g.bind(node='v').nodes(vs)

g.plot()
```

### Example

```
import graphistry

es = pandas.DataFrame({'src': [0,1,2], 'dst': [1,2,0]})
g = graphistry.edges(es, 'src', 'dst')

vs = pandas.DataFrame({'v': [0,1,2], 'lbl': ['a', 'b', 'c']})
g = g.nodes(vs, 'v')

g.plot()
```

**Example**

```
import graphistry

def sample_nodes(g, n):
    return g._nodes.sample(n)

df = pandas.DataFrame({'id': [0,1,2], 'v': [1,2,0]})

graphistry
    .nodes(df, 'id')
    ..nodes(sample_nodes, n=2)
    ..nodes(sample_nodes, None, 2) # equivalent
    .plot()
```

**nodex1** (*xls\_or\_url*, *source='default'*, *engine=None*, *verbose=False*)

**pandas2igraph** (*edges*, *directed=True*)

Convert a pandas edge dataframe to an IGraph graph.

Uses current bindings. Defaults to treating edges as directed.

**Example**

```
import graphistry
g = graphistry.bind()

es = pandas.DataFrame({'src': [0,1,2], 'dst': [1,2,0]})
g = g.bind(source='src', destination='dst')

ig = g.pandas2igraph(es)
ig.vs['community'] = ig.community_infomap().membership
g.bind(point_color='community').plot(ig)
```

**pipe** (*graph\_transform*, *\*args*, *\*\*kwargs*)

Create new Plotter derived from current

**Parameters** *graph\_transform* (*Callable*) –

**Example: Simple**

```
import graphistry

def fill_missing_bindings(g, source='src', destination='dst'):
    return g.bind(source=source, destination=destination)

graphistry
    .edges(pandas.DataFrame({'src': [0,1,2], 'd': [1,2,0]}))
```

(continues on next page)

(continued from previous page)

```
.pipe(fill_missing_bindings, destination='d') # binds 'src'
.plot()
```

**Return type** `Plottable`

**plot** (*graph=None, nodes=None, name=None, description=None, render=None, skip\_upload=False, as\_files=False, memoize=True, extra\_html="", override\_html\_style=None*)  
Upload data to the Graphistry server and show as an iframe of it.

Uses the currently bound schema structure and visual encodings. Optional parameters override the current bindings.

When used in a notebook environment, will also show an iframe of the visualization.

#### Parameters

- **graph** (*Any*) – Edge table (pandas, arrow, cudf) or graph (NetworkX, IGraph).
- **nodes** (*Any*) – Nodes table (pandas, arrow, cudf)
- **name** (*str*) – Upload name.
- **description** (*str*) – Upload description.
- **render** (*bool*) – Whether to render the visualization using the native notebook environment (default True), or return the visualization URL
- **skip\_upload** (*bool*) – Return node/edge/bindings that would have been uploaded. By default, upload happens.
- **as\_files** (*bool*) – Upload distinct node/edge files under the managed Files PI. Default off, will switch to default-on when stable.
- **memoize** (*bool*) – Tries to memoize pandas/cudf->arrow conversion, including skipping upload. Default on.
- **extra\_html** (*Optional[str]*) – Allow injecting arbitrary HTML into the visualization iframe.
- **override\_html\_style** (*Optional[str]*) – Set fully custom style tag.

#### Example: Simple

```
import graphistry
es = pandas.DataFrame({'src': [0,1,2], 'dst': [1,2,0]})
graphistry
    .bind(source='src', destination='dst')
    .edges(es)
    .plot()
```

#### Example: Shorthand

```
import graphistry
es = pandas.DataFrame({'src': [0,1,2], 'dst': [1,2,0]})
graphistry
    .bind(source='src', destination='dst')
    .plot(es)
```

**privacy** (*mode=None, notify=None, invited\_users=None, message=None*)  
Set local sharing mode

**Parameters**

- **mode** (*Optional [Mode]*) – Either “private”, “public”, or inherit from global privacy()
- **notify** (*Optional [bool]*) – Whether to email the recipient(s) upon upload, defaults to global privacy()
- **invited\_users** (*Optional [List]*) – List of recipients, where each is {“email”: str, “action”: str} and action is “10” (view) or “20” (edit), defaults to global privacy()
- **message** (*Optional [str]*) – Email to send when notify=True

Requires an account with sharing capabilities.

Shared datasets will appear in recipients’ galleries.

If mode is set to “private”, only accounts in invited\_users list can access. Mode “public” permits viewing by any user with the URL.

Action “10” (view) gives read access, while action “20” (edit) gives edit access, like changing the sharing mode.

When notify is true, uploads will trigger notification emails to invitees. Email will use visualization’s “.name()”

When settings are not specified, they are inherited from the global graphistry.privacy() defaults

**Example: Limit visualizations to current user**

```
import graphistry
graphistry.register(api=3, username='myuser', password='mypassword')

#Subsequent uploads default to using .privacy() settings
users_df = pd.DataFrame({'user': ['a','b','x'], 'boss': ['x', 'x', 'y
↪']})
h = graphistry.hypergraph(users_df, direct=True)
g = h['graph']
g = g.privacy() # default uploads to mode="private"
g.plot()
```

**Example: Default to publicly viewable visualizations**

```
import graphistry
graphistry.register(api=3, username='myuser', password='mypassword')

#Subsequent uploads default to using .privacy() settings
users_df = pd.DataFrame({'user': ['a','b','x'], 'boss': ['x', 'x', 'y
↪']})
h = graphistry.hypergraph(users_df, direct=True)
g = h['graph']
#g = g.privacy(mode="public") # can skip calling .privacy() for this_
↪default
g.plot()
```

**Example: Default to sharing with select teammates, and keep notifications opt-in**

```
import graphistry
graphistry.register(api=3, username='myuser', password='mypassword')

#Subsequent uploads default to using .privacy() settings
users_df = pd.DataFrame({'user': ['a','b','x'], 'boss': ['x', 'x', 'y
↪']})
```

(continues on next page)

(continued from previous page)

```

h = graphistry.hypergraph(users_df, direct=True)
g = h['graph']
g = g.privacy(
    mode="private",
    invited_users=[
        {"email": "friend1@acme.org", "action": "10"}, # view
        {"email": "friend2@acme.org", "action": "20"}, # edit
    ],
    notify=False)
g.plot()

```

**Example: Keep visualizations public and email notifications upon upload**

```

import graphistry
graphistry.register(api=3, username='myuser', password='mypassword')

#Subsequent uploads default to using .privacy() settings
users_df = pd.DataFrame({'user': ['a','b','x'], 'boss': ['x', 'x', 'y']
↪})
h = graphistry.hypergraph(users_df, direct=True)
g = h['graph']
g = g.name('my cool viz') # For friendlier invitations
g = g.privacy(
    mode="public",
    invited_users=[
        {"email": "friend1@acme.org", "action": "10"}, # view
        {"email": "friend2@acme.org", "action": "20"}, # edit
    ],
    notify=True)
g.plot()

```

**reset\_caches()**

Reset memoization caches

**scene\_settings** (menu=None, info=None, show\_arrows=None, point\_size=None, edge\_curvature=None, edge\_opacity=None, point\_opacity=None)

Set scene options. Additive over previous settings.

Corresponds to options at <https://hub.graphistry.com/docs/api/1/rest/url/#urloptions>**Example: Hide arrows and straighten edges**

```

import graphistry, pandas as pd
edges = pd.DataFrame({'s': ['a','b','c','d'], 'boss': ['c','c','e','e']
↪})
nodes = pd.DataFrame({
    'n': ['a', 'b', 'c', 'd', 'e'],
    'y': [1, 1, 2, 3, 4],
    'x': [1, 1, 0, 0, 0],
})
g = (graphistry
    .edges(edges, 's', 'd')
    .nodes(nodes, 'n')
    .scene_settings(show_arrows=False, edge_curvature=0.0)
g.plot()

```

**Parameters**

- **menu** (Optional[bool]) –
- **info** (Optional[bool]) –
- **show\_arrows** (Optional[bool]) –
- **point\_size** (Optional[float]) –
- **edge\_curvature** (Optional[float]) –
- **edge\_opacity** (Optional[float]) –
- **point\_opacity** (Optional[float]) –

**settings** (*height=None, url\_params={}, render=None*)

Specify iframe height and add URL parameter dictionary.

The library takes care of URI component encoding for the dictionary.

#### Parameters

- **height** (*int*) – Height in pixels.
- **url\_params** (*dict*) – Dictionary of querystring parameters to append to the URL.
- **render** (*bool*) – Whether to render the visualization using the native notebook environment (default True), or return the visualization URL

**style** (*fg=None, bg=None, page=None, logo=None*)

Set general visual styles

See `.bind()` and `.settings(url_params={})` for additional styling options, and `addStyle()` for another way to set the same attributes.

To facilitate reuse and replayable notebooks, the `style()` call is chainable. Invocation does not effect the old style: it instead returns a new Plotter instance with the new styles added to the existing ones. Both the old and new styles can then be used for different graphs.

`style()` will fully replace any defined parameter in the existing style settings, while `addStyle()` will merge over previous values

#### Parameters

- **fg** (*dict*) – Dictionary { 'blendMode': str } of any valid CSS blend mode
- **bg** (*dict*) – Nested dictionary of page background properties. { 'color': str, 'gradient': { 'kind': str, 'position': str, 'stops': list }, 'image': { 'url': str, 'width': int, 'height': int, 'blendMode': str } }
- **logo** (*dict*) – Nested dictionary of logo properties. { 'url': str, 'autoInvert': bool, 'position': str, 'dimensions': { 'maxWidth': int, 'maxHeight': int }, 'crop': { 'top': int, 'left': int, 'bottom': int, 'right': int }, 'padding': { 'top': int, 'left': int, 'bottom': int, 'right': int }, 'style': str }
- **page** (*dict*) – Dictionary of page metadata settings. { 'favicon': str, 'title': str }

**Returns** Plotter

**Return type** Plotter

**Example: Chained merge - results in url and blendMode being set, while color is dropped**

```
g2 = g.style(bg={'color': 'black'}, fg={'blendMode': 'screen'})
g3 = g2.style(bg={'image': {'url': 'http://site.com/watermark.png'}})
```

**Example: Gradient background**

```
g.style(bg={'gradient': {'kind': 'linear', 'position': 45, 'stops': [[
↪ 'rgb(0,0,0)', '0%'], ['rgb(255,255,255)', '100%']]})
```

**Example: Page settings**

```
g.style(page={'title': 'Site - {{ name }}', 'favicon': 'http://site.com/
↪ logo.ico'})
```

**tigergraph** (*protocol='http', server='localhost', web\_port=14240, api\_port=9000, db=None, user='tigergraph', pwd='tigergraph', verbose=False*)  
 Register Tigergraph connection setting defaults

**Parameters**

- **protocol** (*Optional[str]*) – Protocol used to contact the database.
- **server** (*Optional[str]*) – Domain of the database
- **web\_port** (*Optional[int]*) –
- **api\_port** (*Optional[int]*) –
- **db** (*Optional[str]*) – Name of the database
- **user** (*Optional[str]*) –
- **pwd** (*Optional[str]*) –
- **verbose** (*Optional[bool]*) – Whether to print operations

**Returns** Plotter

**Return type** Plotter

**Example: Standard**

```
import graphistry
tg = graphistry.tigergraph(protocol='https', server='acme.com', db='my_db
↪', user='alice', pwd='tigergraph2')
```

**to\_cugraph** (*directed=True, include\_nodes=True, node\_attributes=None, edge\_attributes=None, kind='Graph'*)

Convert current graph to a cugraph.Graph object

To assign an edge weight, use *g.bind(edge\_weight='some\_col').to\_cugraph()*

Load from pandas, cudf, or dask\_cudf DataFrames

**Parameters**

- **directed** (*bool*) –
- **include\_nodes** (*bool*) –
- **node\_attributes** (*Optional[List[str]]*) –
- **edge\_attributes** (*Optional[List[str]]*) –
- **kind** (*Literal['Graph', 'MultiGraph', 'BiPartiteGraph']*) –

**to\_igraph** (*directed=True, use\_vids=False, include\_nodes=True, node\_attributes=None, edge\_attributes=None*)

Convert current item to igraph Graph . See examples in *from\_igraph*.

**Parameters**



- **directed** (*bool*) – Whether to create a directed graph (default True)
- **include\_nodes** (*bool*) – Whether to ingest the nodes table, if it exists (default True)
- **node\_attributes** (*Optional[List[str]*) – Which node attributes to load, None means all (default None)
- **edge\_attributes** (*Optional[List[str]*) – Which edge attributes to load, None means all (default None)
- **use\_vids** (*bool*) – Whether to interpret IDs as igrph vertex IDs, which must be non-negative integers (default False)

```
graphistry.PlotterBase.maybe_cudf()
graphistry.PlotterBase.maybe_dask_cudf()
graphistry.PlotterBase.maybe_dask_dataframe()
graphistry.PlotterBase.maybe_spark()
```

## 1.2 Plotter Modules

```
class graphistry.Plottable.Plottable(*args, **kwargs)
```

Bases: object

**DGL\_graph:** *Optional[Any]*

**bind** (*source=None, destination=None, node=None, edge=None, edge\_title=None, edge\_label=None, edge\_color=None, edge\_weight=None, edge\_size=None, edge\_opacity=None, edge\_icon=None, edge\_source\_color=None, edge\_destination\_color=None, point\_title=None, point\_label=None, point\_color=None, point\_weight=None, point\_size=None, point\_opacity=None, point\_icon=None, point\_x=None, point\_y=None*)

**chain** (*ops*)

*ops* is List[ASTObject]

**Parameters** *ops* (List[Any]) –

**Return type** Plottable

**collapse** (*node, attribute, column, self\_edges=False, unwrap=False, verbose=False*)

**Parameters**

- **node** (Union[str, int]) –
- **attribute** (Union[str, int]) –
- **column** (Union[str, int]) –
- **self\_edges** (bool) –
- **unwrap** (bool) –
- **verbose** (bool) –

**Return type** Plottable

**compute\_cugraph** (*alg, out\_col=None, params={}, kind='Graph', directed=True, G=None*)

**Parameters**

- **alg** (str) –

- **out\_col** (Optional[str]) –
- **params** (dict) –
- **kind** (Literal['Graph', 'MultiGraph', 'BiPartiteGraph']) –
- **G** (Optional[Any]) –

**copy** ()

**drop\_nodes** (*nodes*)

**Parameters** **nodes** (Any) –

**Return type** Plottable

**edges** (*edges, source=None, destination=None, edge=None, \*args, \*\*kwargs*)

**Parameters**

- **edges** (Union[Callable, Any]) –
- **source** (Optional[str]) –
- **destination** (Optional[str]) –
- **edge** (Optional[str]) –

**Return type** Plottable

**filter\_edges\_by\_dict** (*filter\_dict=None*)

**Parameters** **filter\_dict** (Optional[dict]) –

**Return type** Plottable

**filter\_nodes\_by\_dict** (*filter\_dict=None*)

**Parameters** **filter\_dict** (Optional[dict]) –

**Return type** Plottable

**from\_cugraph** (*G, node\_attributes=None, edge\_attributes=None, load\_nodes=True, load\_edges=True, merge\_if\_existing=True*)

**Parameters**

- **node\_attributes** (Optional[List[str]]) –
- **edge\_attributes** (Optional[List[str]]) –
- **load\_nodes** (bool) –
- **load\_edges** (bool) –
- **merge\_if\_existing** (bool) –

**from\_igraph** (*ig, node\_attributes=None, edge\_attributes=None, load\_nodes=True, load\_edges=True, merge\_if\_existing=True*)

**Parameters**

- **node\_attributes** (Optional[List[str]]) –
- **edge\_attributes** (Optional[List[str]]) –
- **load\_nodes** (bool) –
- **load\_edges** (bool) –
- **merge\_if\_existing** (bool) –

**get\_degrees** (*col='degree', degree\_in='degree\_in', degree\_out='degree\_out'*)

**Parameters**

- **col** (str) –
- **degree\_in** (str) –
- **degree\_out** (str) –

**Return type** Plottable

**get\_indegrees** (*col='degree\_in'*)

**Parameters** **col** (str) –

**Return type** Plottable

**get\_outdegrees** (*col='degree\_out'*)

**Parameters** **col** (str) –

**Return type** Plottable

**get\_topological\_levels** (*level\_col='level', allow\_cycles=True, warn\_cycles=True, remove\_self\_loops=True*)

**Parameters**

- **level\_col** (str) –
- **allow\_cycles** (bool) –
- **warn\_cycles** (bool) –
- **remove\_self\_loops** (bool) –

**Return type** Plottable

**hop** (*nodes, hops=1, to\_fixed\_point=False, direction='forward', edge\_match=None, source\_node\_match=None, destination\_node\_match=None, source\_node\_query=None, destination\_node\_query=None, edge\_query=None, return\_as\_wave\_front=False, target\_wave\_front=None*)

**Parameters**

- **nodes** (Optional[DataFrame]) –
- **hops** (Optional[int]) –
- **to\_fixed\_point** (bool) –
- **direction** (str) –
- **edge\_match** (Optional[dict]) –
- **source\_node\_match** (Optional[dict]) –
- **destination\_node\_match** (Optional[dict]) –
- **source\_node\_query** (Optional[str]) –
- **destination\_node\_query** (Optional[str]) –
- **edge\_query** (Optional[str]) –
- **return\_as\_wave\_front** (bool) –
- **target\_wave\_front** (Optional[DataFrame]) –

**Return type** Plottable

**keep\_nodes** (*nodes*)

**Parameters** **nodes** (Union[List, Any]) –

**Return type** Plottable

**layout\_cugraph** (*layout='force\_atlas2', params={}, kind='Graph', directed=True, G=None, bind\_position=True, x\_out\_col='x', y\_out\_col='y', play=0*)

**Parameters**

- **layout** (str) –
- **params** (dict) –
- **kind** (Literal['Graph', 'MultiGraph', 'BiPartiteGraph']) –
- **G** (Optional[Any]) –
- **bind\_position** (bool) –
- **x\_out\_col** (str) –
- **y\_out\_col** (str) –
- **play** (Optional[int]) –

**layout\_settings** (*play=None, locked\_x=None, locked\_y=None, locked\_r=None, left=None, top=None, right=None, bottom=None, lin\_log=None, strong\_gravity=None, dissuade\_hubs=None, edge\_influence=None, precision\_vs\_speed=None, gravity=None, scaling\_ratio=None*)

**Parameters**

- **play** (Optional[int]) –
- **locked\_x** (Optional[bool]) –
- **locked\_y** (Optional[bool]) –
- **locked\_r** (Optional[bool]) –
- **left** (Optional[float]) –
- **top** (Optional[float]) –
- **right** (Optional[float]) –
- **bottom** (Optional[float]) –
- **lin\_log** (Optional[bool]) –
- **strong\_gravity** (Optional[bool]) –
- **dissuade\_hubs** (Optional[bool]) –
- **edge\_influence** (Optional[float]) –
- **precision\_vs\_speed** (Optional[float]) –
- **gravity** (Optional[float]) –
- **scaling\_ratio** (Optional[float]) –

**materialize\_nodes** (*reuse=True, engine='auto'*)

**Parameters**

- **reuse** (bool) –
- **engine** (Union[Engine, Literal['auto']]) –

**Return type** Plottable

**nodes** (*nodes*, *node=None*, \*args, \*\*kwargs)

**Parameters**

- **nodes** (Union[Callable, Any]) –
- **node** (Optional[str]) –

**Return type** Plottable

**pipe** (*graph\_transform*, \*args, \*\*kwargs)

**Parameters** **graph\_transform** (Callable) –

**Return type** Plottable

**prune\_self\_edges** ()

**Return type** Plottable

**to\_cugraph** (*directed=True*, *include\_nodes=True*, *node\_attributes=None*, *edge\_attributes=None*, *kind='Graph'*)

**Parameters**

- **directed** (bool) –
- **include\_nodes** (bool) –
- **node\_attributes** (Optional[List[str]]) –
- **edge\_attributes** (Optional[List[str]]) –
- **kind** (Literal['Graph', 'MultiGraph', 'BiPartiteGraph']) –

**Return type** Any

**to\_igraph** (*directed=True*, *use\_vids=False*, *include\_nodes=True*, *node\_attributes=None*, *edge\_attributes=None*)

**Parameters**

- **directed** (bool) –
- **use\_vids** (bool) –
- **include\_nodes** (bool) –
- **node\_attributes** (Optional[List[str]]) –
- **edge\_attributes** (Optional[List[str]]) –

**Return type** Any



## 2.1 iGraph

```
graphistry.plugins.igraph.compute_igraph(self, alg, out_col=None, directed=None, use_vids=False, params={}, stringify_rich_types=True)
```

Enrich or replace graph using igraph methods

### Parameters

- **alg** (*str*) – Name of an `igraph.Graph` method like `pagerank`
- **out\_col** (*Optional[str]*) – For algorithms that generate a node attribute column, `out_col` is the desired output column name. When `None`, use the algorithm’s name. (default `None`)
- **directed** (*Optional[bool]*) – During the `to_igraph` conversion, whether to be directed. If `None`, try `directed` and then `undirected`. (default `None`)
- **use\_vids** (*bool*) – During the `to_igraph` conversion, whether to interpret IDs as igraph vertex IDs (non-negative integers) or arbitrary values (`False`, default)
- **params** (*dict*) – Any named parameters to pass to the underlying igraph method
- **stringify\_rich\_types** (*bool*) – When rich types like `igraph.Graph` are returned, which may be problematic for downstream rendering, coerce them to strings

**Returns** Plotter

**Return type** Plotter

### Example: Pagerank

```
import graphistry, pandas as pd
edges = pd.DataFrame({'s': ['a', 'b', 'c', 'd'], 'd': ['c', 'c', 'e', 'e']})
g = graphistry.edges(edges, 's', 'd')
g2 = g.compute_igraph('pagerank')
assert 'pagerank' in g2._nodes.columns
```

### Example: Pagerank with custom name

```
import graphistry, pandas as pd
edges = pd.DataFrame({'s': ['a', 'b', 'c', 'd'], 'd': ['c', 'c', 'e', 'e']})
g = graphistry.edges(edges, 's', 'd')
g2 = g.compute_igraph('pagerank', out_col='my_pr')
assert 'my_pr' in g2._nodes.columns
```

**Example: Pagerank on an undirected**

```
import graphistry, pandas as pd
edges = pd.DataFrame({'s': ['a', 'b', 'c', 'd'], 'd': ['c', 'c', 'e', 'e']})
g = graphistry.edges(edges, 's', 'd')
g2 = g.compute_igraph('pagerank', directed=False)
assert 'pagerank' in g2._nodes.columns
```

**Example: Pagerank with custom parameters**

```
import graphistry, pandas as pd
edges = pd.DataFrame({'s': ['a', 'b', 'c', 'd'], 'd': ['c', 'c', 'e', 'e']})
g = graphistry.edges(edges, 's', 'd')
g2 = g.compute_igraph('pagerank', params={'damping': 0.85})
assert 'pagerank' in g2._nodes.columns
```

**Parameters** `self` (Plottable) –

```
graphistry.plugins.igraph.from_igraph(self, ig, node_attributes=None,
                                     edge_attributes=None, load_nodes=True,
                                     load_edges=True, merge_if_existing=True)
```

Convert igraph object into Plotter

If base `g` has `_node`, `_source`, `_destination` definitions, use them

When `merge_if_existing` with preexisting nodes/edges df and shapes match `ig`, combine attributes

For `merge_if_existing` to work with edges, must set `g._edge` and have corresponding edge index attribute in `igraph.Graph`

**Parameters**

- **ig** (*igraph*) – Source igraph object
- **node\_attributes** (*Optional[List[str]]*) – Subset of node attributes to load; None means all (default)
- **edge\_attributes** (*Optional[List[str]]*) – Subset of edge attributes to load; None means all (default)
- **load\_nodes** (*bool*) – Whether to load nodes dataframe (default True)
- **load\_edges** (*bool*) – Whether to load edges dataframe (default True)
- **merge\_if\_existing** (*bool*) – Whether to merge with existing node/edge dataframes (default True)
- **merge\_if\_existing** – bool

**Return type** Plottable

**Returns** Plotter

**Example: Convert from igraph, including all node/edge properties**

```
import graphistry, pandas as pd
edges = pd.DataFrame({'s': ['a', 'b', 'c', 'd'], 'd': ['b', 'c', 'd', 'e'], 'v': [101, 102, 103, 104]})
g = graphistry.edges(edges, 's', 'd').materialize_nodes().get_degrees()
assert 'degree' in g._nodes.columns
g2 = g.from_igraph(g.to_igraph())
assert len(g2._nodes.columns) == len(g._nodes.columns)
```



**Example: Enrich from igraph, but only load in 1 node attribute**

```

import graphistry, pandas as pd
edges = pd.DataFrame({'s': ['a', 'b', 'c', 'd'], 'd': ['b', 'c', 'd', 'e'], 'v
↔': [101, 102, 103, 104]})
g = graphistry.edges(edges, 's', 'd').materialize_nodes().get_degree()
assert 'degree' in g._nodes
ig = g.to_igraph(include_nodes=False)
assert 'degree' not in ig.vs
ig.vs['pagerank'] = ig.pagerank()
g2 = g.from_igraph(ig, load_edges=False, node_attributes=[g._node, 'pagerank
↔'])
assert 'pagerank' in g2._nodes
assert 'degree' in g2._nodes

```

`graphistry.plugins.igraph.layout_igraph`(*self*, *layout*, *directed=None*, *use\_vids=False*, *bind\_position=True*, *x\_out\_col='x'*, *y\_out\_col='y'*, *play=0*, *params={}*)

Compute graph layout using igraph algorithm. For a list of layouts, see `layout_algs` or `igraph` documentation.

**Parameters**

- **layout** (*str*) – Name of an `igraph.Graph.layout` method like *sugiyama*
- **directed** (*Optional[bool]*) – During the `to_igraph` conversion, whether to be directed. If `None`, try `directed` and then `undirected`. (default `None`)
- **use\_vids** (*bool*) – Whether to use `igraph` vertex ids (non-negative integers) or arbitrary node ids (`False`, default)
- **bind\_position** (*bool*) – Whether to call `bind(point_x=, point_y=)` (default `True`)
- **x\_out\_col** (*str*) – Attribute to write x position to. (default `'x'`)
- **y\_out\_col** (*str*) – Attribute to write x position to. (default `'y'`)
- **play** (*Optional[str]*) – If defined, set `settings(url_params={'play': play})`. (default `0`)
- **params** (*dict*) – Any named parameters to pass to the underlying `igraph` method

**Returns** Plotter

**Return type** Plotter

**Example: Sugiyama layout**

```

import graphistry, pandas as pd
edges = pd.DataFrame({'s': ['a', 'b', 'c', 'd'], 'd': ['b', 'c', 'd', 'e']})
g = graphistry.edges(edges, 's', 'd')
g2 = g.layout_igraph('sugiyama')
assert 'x' in g2._nodes
g2.plot()

```

**Example: Change which column names are generated**

```

import graphistry, pandas as pd
edges = pd.DataFrame({'s': ['a', 'b', 'c', 'd'], 'd': ['b', 'c', 'd', 'e']})
g = graphistry.edges(edges, 's', 'd')
g2 = g.layout_igraph('sugiyama', x_out_col='my_x', y_out_col='my_y')
assert 'my_x' in g2._nodes

```

(continues on next page)

(continued from previous page)

```
assert g2._point_x == 'my_x'
g2.plot()
```

**Example: Pass parameters to layout methods - Sort nodes by degree**

```
import graphistry, pandas as pd
edges = pd.DataFrame({'s': ['a', 'b', 'c', 'd'], 'd': ['b', 'c', 'd', 'e']})
g = graphistry.edges(edges, 's', 'd')
g2 = g.get_degrees()
assert 'degree' in g._nodes.columns
g3 = g.layout_igraph('sugiyama', params={'layers': 'degree'})
g3.plot()
```

**Parameters** `self` (Plottable) –

```
graphistry.plugins.igraph.to_igraph(self, directed=True, include_nodes=True,
                                     node_attributes=None, edge_attributes=None,
                                     use_vids=False)
```

Convert current item to igraph Graph . See examples in `from_igraph`.**Parameters**

- **directed** (*bool*) – Whether to create a directed graph (default True)
- **include\_nodes** (*bool*) – Whether to ingest the nodes table, if it exists (default True)
- **node\_attributes** (*Optional[List[str]]*) – Which node attributes to load, None means all (default None)
- **edge\_attributes** (*Optional[List[str]]*) – Which edge attributes to load, None means all (default None)
- **use\_vids** (*bool*) – Whether to interpret IDs as igraph vertex IDs, which must be non-negative integers (default False)
- **self** (Plottable) –

## 2.2 CuGraph

```
graphistry.plugins.cugraph.compute_cugraph(self, alg, out_col=None, params={},
                                             kind='Graph', directed=True, G=None)
```

Run cugraph algorithm on graph. For algorithm parameters, see cuGraph docs.

**Parameters**

- **alg** (*str*) – algorithm name
- **out\_col** (*Optional[str]*) – node table output column name, defaults to alg param
- **params** (*dict*) – algorithm parameters passed to cuGraph as kwargs
- **kind** (*CuGraphKind*) – kind of cugraph to use
- **directed** (*bool*) – whether graph is directed
- **G** (*Optional[cugraph.Graph]*) – cugraph graph to use; if None, use self

**Returns** Plottable**Return type** Plottable

**Example: Pagerank**

```
g2 = g.compute_cugraph('pagerank')
assert 'pagerank' in g2._nodes.columns
```

**Example: Katz centrality with rename**

```
g2 = g.compute_cugraph('katz_centrality', out_col='katz_centrality_renamed')
assert 'katz_centrality_renamed' in g2._nodes.columns
```

**Example: Pass params to cugraph**

```
g2 = g.compute_cugraph('k_truss', params={'k': 2})
assert 'k_truss' in g2._nodes.columns
```

**Parameters** `self` (Plottable) –

`graphistry.plugins.cugraph.df_to_gdf(df)`

**Parameters** `df` (Any) –

`graphistry.plugins.cugraph.from_cugraph(self, G, node_attributes=None, edge_attributes=None, load_nodes=True, load_edges=True, merge_if_existing=True)`

If bound IDs, use the same IDs in the returned graph.

If non-empty nodes/edges, instead of returning G's topology, use existing topology and merge in G's attributes

**Parameters**

- **node\_attributes** (Optional[List[str]]) –
- **edge\_attributes** (Optional[List[str]]) –
- **load\_nodes** (bool) –
- **load\_edges** (bool) –
- **merge\_if\_existing** (bool) –

**Return type** Plottable

`graphistry.plugins.cugraph.layout_cugraph(self, layout='force_atlas2', params={}, kind='Graph', directed=True, G=None, bind_position=True, x_out_col='x', y_out_col='y', play=0)`

Layout the graph using a cuGraph algorithm. For a list of layouts, see cugraph documentation (currently just `force_atlas2`).

**Parameters**

- **layout** (*str*) – Name of an cugraph layout method like *force\_atlas2*
- **params** (*dict*) – Any named parameters to pass to the underlying cugraph method
- **kind** (*CuGraphKind*) – The kind of cugraph Graph
- **directed** (*bool*) – During the to\_cugraph conversion, whether to be directed. (default True)
- **G** (*Optional[Any]*) – The cugraph graph (G) to layout. If None, the current graph is used.
- **bind\_position** (*bool*) – Whether to call `bind(point_x=, point_y=)` (default True)

- **x\_out\_col** (*str*) – Attribute to write x position to. (default ‘x’)
- **y\_out\_col** (*str*) – Attribute to write x position to. (default ‘y’)
- **play** (*Optional[str]*) – If defined, set settings(url\_params={‘play’: play}). (default 0)

**Returns** Plotter

**Return type** Plotter

**Example: ForceAtlas2 layout**

```
import graphistry, pandas as pd
edges = pd.DataFrame({'s': ['a', 'b', 'c', 'd'], 'd': ['b', 'c', 'd', 'e']})
g = graphistry.edges(edges, 's', 'd')
g.layout_cugraph().plot()
```

**Example: Change which column names are generated**

```
import graphistry, pandas as pd
edges = pd.DataFrame({'s': ['a', 'b', 'c', 'd'], 'd': ['b', 'c', 'd', 'e']})
g = graphistry.edges(edges, 's', 'd')
g2 = g.layout_cugraph('force_atlas2', x_out_col='my_x', y_out_col='my_y')
assert 'my_x' in g2._nodes
assert g2._point_x == 'my_x'
g2.plot()
```

**Example: Pass parameters to layout methods**

```
import graphistry, pandas as pd
edges = pd.DataFrame({'s': ['a', 'b', 'c', 'd'], 'd': ['b', 'c', 'd', 'e']})
g = graphistry.edges(edges, 's', 'd')
g2 = g.layout_cugraph('forceatlas_2', params={'lin_log_mode': True, 'prevent_
↪overlapping': True})
g2.plot()
```

**Parameters self** (Plottable) –

graphistry.plugins.cugraph.**to\_cugraph** (*self*, *directed=True*, *include\_nodes=True*,  
*node\_attributes=None*, *edge\_attributes=None*,  
*kind='Graph'*)

Convert current graph to a `cugraph.Graph` object

To assign an edge weight, use `g.bind(edge_weight='some_col').to_cugraph()`

Load from pandas, cudf, or dask\_cudf DataFrames

**Parameters**

- **self** (Plottable) –
- **directed** (bool) –
- **include\_nodes** (bool) –
- **node\_attributes** (Optional[List[str]]) –
- **edge\_attributes** (Optional[List[str]]) –
- **kind** (Literal[‘Graph’, ‘MultiGraph’, ‘BiPartiteGraph’]) –

## 3.1 Compute Modules

### 3.1.1 predicates module

#### 3.1.2 ASTPredicate

**class** graphistry.compute.predicates.ASTPredicate.**ASTPredicate**  
Bases: object

Internal, not intended for use outside of this module. These are fancy columnar predicates used in {k: v, ...} node/edge df matching when going beyond primitive equality

#### 3.1.3 categorical

**class** graphistry.compute.predicates.categorical.**Duplicated** (*keep='first'*)  
Bases: graphistry.compute.predicates.ASTPredicate.ASTPredicate

**Parameters** **keep** (Literal['first', 'last', False]) –

graphistry.compute.predicates.categorical.**duplicated** (*keep='first'*)  
Return whether a given value is duplicated

**Parameters** **keep** (Literal['first', 'last', False]) –

**Return type** Duplicated

#### 3.1.4 is\_in

**class** graphistry.compute.predicates.is\_in.**IsIn** (*options*)  
Bases: graphistry.compute.predicates.ASTPredicate.ASTPredicate

**Parameters** **options** (List[Any]) –

graphistry.compute.predicates.is\_in.**is\_in** (*options*)

**Parameters** **options** (List[Any]) –

**Return type** IsIn

### 3.1.5 numeric

**class** graphistry.compute.predicates.numeric.**Between** (*lower, upper, inclusive=True*)  
Bases: graphistry.compute.predicates.ASTPredicate.ASTPredicate

**Parameters**

- **lower** (float) –
- **upper** (float) –
- **inclusive** (bool) –

**class** graphistry.compute.predicates.numeric.**EQ** (*val*)  
Bases: graphistry.compute.predicates.ASTPredicate.ASTPredicate

**Parameters val** (float) –

**class** graphistry.compute.predicates.numeric.**GE** (*val*)  
Bases: graphistry.compute.predicates.ASTPredicate.ASTPredicate

**Parameters val** (float) –

**class** graphistry.compute.predicates.numeric.**GT** (*val*)  
Bases: graphistry.compute.predicates.ASTPredicate.ASTPredicate

**Parameters val** (float) –

**class** graphistry.compute.predicates.numeric.**IsNA**  
Bases: graphistry.compute.predicates.ASTPredicate.ASTPredicate

**class** graphistry.compute.predicates.numeric.**LE** (*val*)  
Bases: graphistry.compute.predicates.ASTPredicate.ASTPredicate

**Parameters val** (float) –

**class** graphistry.compute.predicates.numeric.**LT** (*val*)  
Bases: graphistry.compute.predicates.ASTPredicate.ASTPredicate

**Parameters val** (float) –

**class** graphistry.compute.predicates.numeric.**NE** (*val*)  
Bases: graphistry.compute.predicates.ASTPredicate.ASTPredicate

**Parameters val** (float) –

**class** graphistry.compute.predicates.numeric.**NotNA**  
Bases: graphistry.compute.predicates.ASTPredicate.ASTPredicate

graphistry.compute.predicates.numeric.**between** (*lower, upper, inclusive=True*)  
Return whether a given value is between a lower and upper threshold

**Parameters**

- **lower** (float) –
- **upper** (float) –
- **inclusive** (bool) –

**Return type** Between

graphistry.compute.predicates.numeric.**eq** (*val*)  
Return whether a given value is equal to a threshold

**Parameters val** (float) –

**Return type** EQ

`graphistry.compute.predicates.numeric.ge(val)`

Return whether a given value is greater than or equal to a threshold

**Parameters** `val` (float) –

**Return type** GE

`graphistry.compute.predicates.numeric.gt(val)`

Return whether a given value is greater than a threshold

**Parameters** `val` (float) –

**Return type** GT

`graphistry.compute.predicates.numeric.isna()`

Return whether a given value is NA

**Return type** IsNA

`graphistry.compute.predicates.numeric.le(val)`

Return whether a given value is less than or equal to a threshold

**Parameters** `val` (float) –

**Return type** LE

`graphistry.compute.predicates.numeric.lt(val)`

Return whether a given value is less than a threshold

**Parameters** `val` (float) –

**Return type** LT

`graphistry.compute.predicates.numeric.ne(val)`

Return whether a given value is not equal to a threshold

**Parameters** `val` (float) –

**Return type** NE

`graphistry.compute.predicates.numeric.notna()`

Return whether a given value is not NA

**Return type** NotNA

### 3.1.6 str

**class** `graphistry.compute.predicates.str.Contains` (*pat*, *case=True*, *flags=0*, *na=None*,  
*regex=True*)

Bases: `graphistry.compute.predicates.ASTPredicate.ASTPredicate`

**Parameters**

- **pat** (str) –
- **case** (bool) –
- **flags** (int) –
- **na** (Optional[bool]) –
- **regex** (bool) –

**class** graphistry.compute.predicates.str.**Endswith** (*pat, na=None*)  
Bases: graphistry.compute.predicates.ASTPredicate.ASTPredicate

**Parameters**

- **pat** (str) –
- **na** (Optional[str]) –

**class** graphistry.compute.predicates.str.**IsAlnum**  
Bases: graphistry.compute.predicates.ASTPredicate.ASTPredicate

**class** graphistry.compute.predicates.str.**IsAlpha**  
Bases: graphistry.compute.predicates.ASTPredicate.ASTPredicate

**class** graphistry.compute.predicates.str.**IsDecimal**  
Bases: graphistry.compute.predicates.ASTPredicate.ASTPredicate

**class** graphistry.compute.predicates.str.**IsDigit**  
Bases: graphistry.compute.predicates.ASTPredicate.ASTPredicate

**class** graphistry.compute.predicates.str.**IsLower**  
Bases: graphistry.compute.predicates.ASTPredicate.ASTPredicate

**class** graphistry.compute.predicates.str.**IsNull**  
Bases: graphistry.compute.predicates.ASTPredicate.ASTPredicate

**class** graphistry.compute.predicates.str.**IsNumeric**  
Bases: graphistry.compute.predicates.ASTPredicate.ASTPredicate

**class** graphistry.compute.predicates.str.**IsSpace**  
Bases: graphistry.compute.predicates.ASTPredicate.ASTPredicate

**class** graphistry.compute.predicates.str.**IsTitle**  
Bases: graphistry.compute.predicates.ASTPredicate.ASTPredicate

**class** graphistry.compute.predicates.str.**IsUpper**  
Bases: graphistry.compute.predicates.ASTPredicate.ASTPredicate

**class** graphistry.compute.predicates.str.**Match** (*pat, case=True, flags=0, na=None*)  
Bases: graphistry.compute.predicates.ASTPredicate.ASTPredicate

**Parameters**

- **pat** (str) –
- **case** (bool) –
- **flags** (int) –
- **na** (Optional[bool]) –

**class** graphistry.compute.predicates.str.**NotNull**  
Bases: graphistry.compute.predicates.ASTPredicate.ASTPredicate

**class** graphistry.compute.predicates.str.**Startswith** (*pat, na=None*)  
Bases: graphistry.compute.predicates.ASTPredicate.ASTPredicate

**Parameters**

- **pat** (str) –
- **na** (Optional[str]) –

graphistry.compute.predicates.str.**contains** (*pat, case=True, flags=0, na=None, regex=True*)

Return whether a given pattern or regex is contained within a string



**Parameters**

- **pat** (str) –
- **case** (bool) –
- **flags** (int) –
- **na** (Optional[bool]) –
- **regex** (bool) –

**Return type** Contains`graphistry.compute.predicates.str.endswith(pat, na=None)`**Parameters**

- **pat** (str) –
- **na** (Optional[str]) –

**Return type** Endswith

`graphistry.compute.predicates.str.isalnum()`  
Return whether a given string is alphanumeric

**Return type** IsAlnum

`graphistry.compute.predicates.str.isalpha()`  
Return whether a given string is alphabetic

**Return type** IsAlpha

`graphistry.compute.predicates.str.isdecimal()`  
Return whether a given string is decimal

**Return type** IsDecimal

`graphistry.compute.predicates.str.isdigit()`  
Return whether a given string is numeric

**Return type** IsDigit

`graphistry.compute.predicates.str.islower()`  
Return whether a given string is lowercase

**Return type** IsLower

`graphistry.compute.predicates.str.isnull()`  
Return whether a given string is null

**Return type** IsNull

`graphistry.compute.predicates.str.isnumeric()`  
Return whether a given string is numeric

**Return type** IsNumeric

`graphistry.compute.predicates.str.isspace()`  
Return whether a given string is whitespace

**Return type** IsSpace

`graphistry.compute.predicates.str.istitle()`  
Return whether a given string is title case

**Return type** IsTitle

`graphistry.compute.predicates.str.isupper()`

Return whether a given string is uppercase

**Return type** IsUpper

`graphistry.compute.predicates.str.match(pat, case=True, flags=0, na=None)`

Return whether a given pattern is at the start of a string

**Parameters**

- **pat** (str) –
- **case** (bool) –
- **flags** (int) –
- **na** (Optional[bool]) –

**Return type** Match

`graphistry.compute.predicates.str.notnull()`

Return whether a given string is not null

**Return type** NotNull

`graphistry.compute.predicates.str.startswith(pat, na=None)`

Return whether a given pattern is at the start of a string

**Parameters**

- **pat** (str) –
- **na** (Optional[str]) –

**Return type** Startswith

### 3.1.7 temporal

**class** `graphistry.compute.predicates.temporal.IsLeapYear`

Bases: `graphistry.compute.predicates.ASTPredicate.ASTPredicate`

**class** `graphistry.compute.predicates.temporal.IsMonthEnd`

Bases: `graphistry.compute.predicates.ASTPredicate.ASTPredicate`

**class** `graphistry.compute.predicates.temporal.IsMonthStart`

Bases: `graphistry.compute.predicates.ASTPredicate.ASTPredicate`

**class** `graphistry.compute.predicates.temporal.IsQuarterEnd`

Bases: `graphistry.compute.predicates.ASTPredicate.ASTPredicate`

**class** `graphistry.compute.predicates.temporal.IsQuarterStart`

Bases: `graphistry.compute.predicates.ASTPredicate.ASTPredicate`

**class** `graphistry.compute.predicates.temporal.IsYearStart`

Bases: `graphistry.compute.predicates.ASTPredicate.ASTPredicate`

`graphistry.compute.predicates.temporal.is_leap_year()`

Return whether a given value is a leap year

**Return type** IsLeapYear

`graphistry.compute.predicates.temporal.is_month_end()`

Return whether a given value is a month end

**Return type** IsMonthEnd

`graphistry.compute.predicates.temporal.is_month_start()`  
Return whether a given value is a month start

**Return type** IsMonthStart

`graphistry.compute.predicates.temporal.is_quarter_end()`  
Return whether a given value is a quarter end

**Return type** IsQuarterEnd

`graphistry.compute.predicates.temporal.is_quarter_start()`  
Return whether a given value is a quarter start

**Return type** IsQuarterStart

`graphistry.compute.predicates.temporal.is_year_start()`  
Return whether a given value is a year start

**Return type** IsYearStart

## 3.2 ComputeMixin module

**class** `graphistry.compute.ComputeMixin.ComputeMixin(*args, **kwargs)`  
Bases: object

**chain** `(*args, **kwargs)`

Experimental: Chain a list of operations

Return subgraph of matches according to the list of node & edge matchers If any matchers are named, add a correspondingly named boolean-valued column to the output

**Parameters** `ops` – List[ASTObject] Various node and edge matchers

**Returns** Plotter

**Return type** Plotter

**Example: Find nodes of some type**

```
from graphistry.ast import n

people_nodes_df = g.chain([ n({"type": "person"}) ])._nodes
```

**Example: Find 2-hop edge sequences with some attribute**

```
from graphistry.ast import e_forward

g_2_hops = g.chain([ e_forward({"interesting": True}, hops=2) ])
g_2_hops.plot()
```

**Example: Find any node 1-2 hops out from another node, and label each hop**

```
from graphistry.ast import n, e_undirected

g_2_hops = g.chain([ n({g._node: "a"}), e_undirected(name="hop1"), e_
↔undirected(name="hop2") ])
print('# first-hop edges:', len(g_2_hops._edges[ g_2_hops._edges.hop1 == True_
↔]))
```

**Example: Transaction nodes between two kinds of risky nodes**

```

from graphistry.ast import n, e_forward, e_reverse

g_risky = g.chain([
    n({"risk1": True}),
    e_forward(to_fixed=True),
    n({"type": "transaction"}, name="hit"),
    e_reverse(to_fixed=True),
    n({"risk2": True})
])
print('# hits:', len(g_risky._nodes[ g_risky._nodes.hit ]))

```

#### Example: Filter by multiple node types at each step using `is_in`

```

from graphistry.ast import n, e_forward, e_reverse, is_in

g_risky = g.chain([
    n({"type": is_in(["person", "company"])}),
    e_forward({"e_type": is_in(["owns", "reviews"])}, to_fixed=True),
    n({"type": is_in(["transaction", "account"])}, name="hit"),
    e_reverse(to_fixed=True),
    n({"risk2": True})
])
print('# hits:', len(g_risky._nodes[ g_risky._nodes.hit ]))

```

**collapse** (*node*, *attribute*, *column*, *self\_edges=False*, *unwrap=False*, *verbose=False*)

Topology-aware collapse by given column attribute starting at *node*

Traverses directed graph from start node *node* and collapses clusters of nodes that share the same property so that topology is preserved.

#### Parameters

- **node** (Union[str, int]) – start *node* to begin traversal
- **attribute** (Union[str, int]) – the given *attribute* to collapse over within *column*
- **column** (Union[str, int]) – the *column* of nodes DataFrame that contains *attribute* to collapse over
- **self\_edges** (bool) – whether to include self edges in the collapsed graph
- **unwrap** (bool) – whether to unwrap the collapsed graph into a single node
- **verbose** (bool) – whether to print out collapse summary information

:returns: A new Graphistry instance with nodes and edges DataFrame containing collapsed nodes and edges given by column attribute – nodes and edges DataFrames contain six new columns *collapse\_{node | edges}* and *final\_{node | edges}*, while original (*node*, *src*, *dst*) columns are left untouched :rtype: Plottable

**drop\_nodes** (*nodes*)

return g with any nodes/edges involving the node id series removed

**filter\_edges\_by\_dict** (*\*args*, *\*\*kwargs*)

filter edges to those that match all values in filter\_dict

**filter\_nodes\_by\_dict** (*\*args*, *\*\*kwargs*)

filter nodes to those that match all values in filter\_dict

**get\_degrees** (*col='degree'*, *degree\_in='degree\_in'*, *degree\_out='degree\_out'*)

Decorate nodes table with degree info

Edges must be dataframe-like: pandas, cudf, ...

Parameters determine generated column names

Warning: Self-cycles are currently double-counted. This may change.

#### Example: Generate degree columns

```
edges = pd.DataFrame({'s': ['a', 'b', 'c', 'd'], 'd': ['c', 'c', 'e', 'e']})
g = graphistry.edges(edges, 's', 'd')
print(g._nodes) # None
g2 = g.get_degrees()
print(g2._nodes) # pd.DataFrame with 'id', 'degree', 'degree_in',
↳ 'degree_out'
```

#### Parameters

- **col** (str) –
- **degree\_in** (str) –
- **degree\_out** (str) –

**get\_indegrees** (col='degree\_in')

See get\_degrees

Parameters **col** (str) –

**get\_outdegrees** (col='degree\_out')

See get\_degrees

Parameters **col** (str) –

**get\_topological\_levels** (level\_col='level', allow\_cycles=True, warn\_cycles=True, remove\_self\_loops=True)

Label nodes on column level\_col based on topological sort depth Supports pandas + cudf, using parallelism within each level computation Options: \* allow\_cycles: if False and detects a cycle, throw ValueError, else break cycle by picking a lowest-in-degree node \* warn\_cycles: if True and detects a cycle, proceed with a warning \* remove\_self\_loops: preprocess by removing self-cycles. Avoids allow\_cycles=False, warn\_cycles=True messages.

Example:

```
edges_df = gpd.DataFrame({'s': ['a', 'b', 'c', 'd'], 'd': ['b', 'c', 'e', 'e']})
g = graphistry.edges(edges_df, 's', 'd')
g2 = g.get_topological_levels()
g2._nodes.info() # pd.DataFrame with | 'id' , 'level' |
```

#### Parameters

- **level\_col** (str) –
- **allow\_cycles** (bool) –
- **warn\_cycles** (bool) –
- **remove\_self\_loops** (bool) –

Return type `Plottable`

**hop** (\*args, \*\*kwargs)

Given a graph and some source nodes, return subgraph of all paths within k-hops from the sources

g: Plotter nodes: dataframe with id column matching g.\_node. None signifies all nodes (default). hops: consider paths of length 1 to 'hops' steps, if any (default 1). to\_fixed\_point: keep hopping until no new nodes are found (ignores hops) direction: 'forward', 'reverse', 'undirected' edge\_match: dict of kv-pairs

to exact match (see also: `filter_edges_by_dict`) `source_node_match`: dict of kv-pairs to match nodes before hopping (including intermediate) `destination_node_match`: dict of kv-pairs to match nodes after hopping (including intermediate) `source_node_query`: dataframe query to match nodes before hopping (including intermediate) `destination_node_query`: dataframe query to match nodes after hopping (including intermediate) `edge_query`: dataframe query to match edges before hopping (including intermediate) `return_as_wave_front`: Only return the nodes/edges reached, ignoring past ones (primarily for internal use) `target_wave_front`: Only consider these nodes for reachability, and for intermediate hops, also consider nodes (primarily for internal use by reverse pass)

**keep\_nodes** (*nodes*)

Limit nodes and edges to those selected by parameter `nodes` For edges, both source and destination must be in `nodes` `Nodes` can be a list or series of node IDs, or a dictionary When a dictionary, each key corresponds to a node column, and nodes will be included when all match

**materialize\_nodes** (*reuse=True, engine='auto'*)

Generate `g._nodes` based on `g._edges`

Uses `g._node` for node id if exists, else 'id'

Edges must be dataframe-like: `cudf`, `pandas`, ...

When `reuse=True` and `g._nodes` is not `None`, use it

**Example: Generate nodes**

```
edges = pd.DataFrame({'s': ['a', 'b', 'c', 'd'], 'd': ['c', 'c', 'e', 'e']})
g = graphistry.edges(edges, 's', 'd')
print(g._nodes) # None
g2 = g.materialize_nodes()
print(g2._nodes) # pd.DataFrame
```

**Parameters**

- **reuse** (bool) –
- **engine** (Union[Engine, Literal['auto']]) –

**Return type** `Plottable`

**prune\_self\_edges** ()

### 3.3 Chain

`graphistry.compute.chain`. **chain** (*self, ops*)

Experimental: Chain a list of operations

Return subgraph of matches according to the list of node & edge matchers If any matchers are named, add a correspondingly named boolean-valued column to the output

**Parameters** `ops` (List[ASTObject]) – List[ASTObject] Various node and edge matchers

**Returns** `Plotter`

**Return type** `Plotter`

**Example: Find nodes of some type**

```
from graphistry.ast import n

people_nodes_df = g.chain([ n({"type": "person"}) ])._nodes
```

**Example: Find 2-hop edge sequences with some attribute**

```
from graphistry.ast import e_forward

g_2_hops = g.chain([ e_forward({"interesting": True}, hops=2) ])
g_2_hops.plot()
```

**Example: Find any node 1-2 hops out from another node, and label each hop**

```
from graphistry.ast import n, e_undirected

g_2_hops = g.chain([ n({g._node: "a"}), e_undirected(name="hop1"), e_
→undirected(name="hop2") ])
print('# first-hop edges:', len(g_2_hops._edges[ g_2_hops._edges.hop1 == True ]))
```

**Example: Transaction nodes between two kinds of risky nodes**

```
from graphistry.ast import n, e_forward, e_reverse

g_risky = g.chain([
    n({"risk1": True}),
    e_forward(to_fixed=True),
    n({"type": "transaction"}, name="hit"),
    e_reverse(to_fixed=True),
    n({"risk2": True})
])
print('# hits:', len(g_risky._nodes[ g_risky._nodes.hit ]))
```

**Example: Filter by multiple node types at each step using is\_in**

```
from graphistry.ast import n, e_forward, e_reverse, is_in

g_risky = g.chain([
    n({"type": is_in(["person", "company"])}),
    e_forward({"e_type": is_in(["owns", "reviews"])}, to_fixed=True),
    n({"type": is_in(["transaction", "account"])}, name="hit"),
    e_reverse(to_fixed=True),
    n({"risk2": True})
])
print('# hits:', len(g_risky._nodes[ g_risky._nodes.hit ]))
```

**Parameters** `self` (Plottable) –`graphistry.compute.chain.combine_steps` (*g, kind, steps*)

Collect nodes and edges, taking care to deduplicate and tag any names

**Parameters**

- **g** (Plottable) –
- **kind** (str) –
- **steps** (List[Tuple[ASTObject, Plottable]]) –

**Return type** DataFrame

## 3.4 Cluster

**class** graphistry.compute.cluster.**ClusterMixin**(\*args, \*\*kwargs)

Bases: object

**dbscan** (min\_dist=0.2, min\_samples=1, cols=None, kind='nodes', fit\_umap\_embedding=True, target=False, verbose=False, engine\_dbscan='sklearn', \*args, \*\*kwargs)

**DBSCAN clustering on cpu or gpu inferred automatically. Adds a `_dbscan` column to nodes or edges.**

NOTE: `g.transform_dbscan(..)` currently unsupported on GPU.

Examples:

```
g = graphistry.edges(edf, 'src', 'dst').nodes(ndf, 'node')

# cluster by UMAP embeddings
kind = 'nodes' | 'edges'
g2 = g.umap(kind=kind).dbscan(kind=kind)
print(g2._nodes['_dbscan']) | print(g2._edges['_dbscan'])

# dbscan in umap or featurize API
g2 = g.umap(dbscan=True, min_dist=1.2, min_samples=2, **kwargs)
# or, here dbscan is inferred from features, not umap embeddings
g2 = g.featurize(dbscan=True, min_dist=1.2, min_samples=2, **kwargs)

# and via chaining,
g2 = g.umap().dbscan(min_dist=1.2, min_samples=2, **kwargs)

# cluster by feature embeddings
g2 = g.featurize().dbscan(**kwargs)

# cluster by a given set of feature column attributes, or with target=True
g2 = g.featurize().dbscan(cols=['ip_172', 'location', 'alert'], target=False,
↳ **kwargs)

# equivalent to above (ie, cols != None and umap=True will still use features
↳ dataframe, rather than UMAP embeddings)
g2 = g.umap().dbscan(cols=['ip_172', 'location', 'alert'], umap=True | False,
↳ **kwargs)

g2.plot() # color by `_dbscan` column
```

**Useful:** Enriching the graph with cluster labels from UMAP is useful for visualizing clusters in the graph by color, size, etc, as well as assessing metrics per cluster, e.g. <https://github.com/graphistry/pygraphistry/blob/master/demos/ai/cyber/cyber-redteam-umap-demo.ipynb>

**Args:**

**min\_dist float** The maximum distance between two samples for them to be considered as in the same neighborhood.

**kind str** 'nodes' or 'edges'

**cols** list of columns to use for clustering given `g.featurize` has been run, nice way to slice features or targets by fragments of interest, e.g. ['ip\_172', 'location', 'ssh', 'warnings']

**fit\_umap\_embedding bool** whether to use UMAP embeddings or features dataframe to cluster DBSCAN



**min\_samples** The number of samples in a neighborhood for a point to be considered as a core point. This includes the point itself.

**target** whether to use the target column as the clustering feature

### Parameters

- **min\_dist** (float)–
- **min\_samples** (int)–
- **cols** (Union[List, str, None])–
- **kind** (str)–
- **fit\_umap\_embedding** (bool)–
- **target** (bool)–
- **verbose** (bool)–
- **engine\_dbscan** (str)–

**transform\_dbscan** (*df*, *y=None*, *min\_dist='auto'*, *infer\_umap\_embedding=False*, *sample=None*, *n\_neighbors=None*, *kind='nodes'*, *return\_graph=True*, *verbose=False*)

Transforms a minibatch dataframe to one with a new column ‘\_dbscan’ containing the DBSCAN cluster labels on the minibatch and generates a graph with the minibatch and the original graph, with edges between the minibatch and the original graph inferred from the umap embedding or features dataframe. Graph nodes | edges will be colored by ‘\_dbscan’ column.

Examples:

```
fit:
    g = graphistry.edges(edf, 'src', 'dst').nodes(ndf, 'node')
    g2 = g.featurize().dbscan()

predict:
::

    emb, X, _, ndf = g2.transform_dbscan(ndf, return_graph=False)
    # or
    g3 = g2.transform_dbscan(ndf, return_graph=True)
    g3.plot()
```

likewise for umap:

```
fit:
    g = graphistry.edges(edf, 'src', 'dst').nodes(ndf, 'node')
    g2 = g.umap(X=., y=.).dbscan()

predict:
::

    emb, X, y, ndf = g2.transform_dbscan(ndf, ndf, return_graph=False)
    # or
    g3 = g2.transform_dbscan(ndf, ndf, return_graph=True)
    g3.plot()
```

**Args:**

**df** dataframe to transform

**y** optional labels dataframe

**min\_dist** The maximum distance between two samples for them to be considered as in the same neighborhood. smaller values will result in less edges between the minibatch and the original graph. Default 'auto', infers min\_dist from the mean distance and std of new points to the original graph

**fit\_umap\_embedding** whether to use UMAP embeddings or features dataframe when inferring edges between the minibatch and the original graph. Default False, uses the features dataframe

**sample** number of samples to use when inferring edges between the minibatch and the original graph, if None, will only use closest point to the minibatch. If greater than 0, will sample the closest *sample* points in existing graph to pull in more edges. Default None

**kind** 'nodes' or 'edges'

**return\_graph** whether to return a graph or the (emb, X, y, minibatch df enriched with DBSCAN labels), default True inferred graph supports kind='nodes' only.

**verbose** whether to print out progress, default False

### Parameters

- **df** (DataFrame) –
- **y** (Optional[DataFrame]) –
- **min\_dist** (Union[float, str]) –
- **infer\_umap\_embedding** (bool) –
- **sample** (Optional[int]) –
- **n\_neighbors** (Optional[int]) –
- **kind** (str) –
- **return\_graph** (bool) –
- **verbose** (bool) –

```
graphistry.compute.cluster.dbscan_fit(g, dbscan, kind='nodes', cols=None,
                                     use_umap_embedding=True, target=False, verbose=False)
```

Fits clustering on UMAP embeddings if `umap` is `True`, otherwise on the features dataframe or target dataframe if `target` is `True`.

### Args:

**g** graphistry graph

**kind** 'nodes' or 'edges'

**cols** list of columns to use for clustering given *g.featurize* has been run

**use\_umap\_embedding** whether to use UMAP embeddings or features dataframe for clustering (default: True)

### Parameters

- **g** (Any) –
- **dbscan** (Any) –
- **kind** (str) –

- **cols** (Union[List, str, None]) –
- **use\_umap\_embedding** (bool) –
- **target** (bool) –
- **verbose** (bool) –

graphistry.compute.cluster.**dbscan\_predict** (*X, model*)

DBSCAN has no predict per se, so we reverse engineer one here from <https://stackoverflow.com/questions/27822752/scikit-learn-predicting-new-points-with-dbscan>

#### Parameters

- **X** (DataFrame) –
- **model** (Any) –

graphistry.compute.cluster.**get\_model\_matrix** (*g, kind, cols, umap, target*)

Allows for a single function to get the model matrix for both nodes and edges as well as targets, embeddings, and features

#### Args:

**g** graphistry graph

**kind** 'nodes' or 'edges'

**cols** list of columns to use for clustering given *g.featurize* has been run

**umap** whether to use UMAP embeddings or features dataframe

**target** whether to use the target dataframe or features dataframe

**Returns:** pd.DataFrame: dataframe of model matrix given the inputs

#### Parameters

- **kind** (str) –
- **cols** (Union[List, str, None]) –

graphistry.compute.cluster.**lazy\_cudf\_import\_has\_dependency** ()

graphistry.compute.cluster.**lazy\_dbscan\_import\_has\_dependency** ()

graphistry.compute.cluster.**make\_safe\_gpu\_dataframes** (*X, y, engine*)  
helper method to coerce a dataframe to the correct type (pd vs cudf)

graphistry.compute.cluster.**resolve\_cpu\_gpu\_engine** (*engine*)

**Parameters** **engine** (Literal['cuml', 'umap\_learn', 'auto']) –

**Return type** Literal['cuml', 'umap\_learn']

## 3.5 Collapse

`graphistry.compute.collapse.check_default_columns_present_and_coerce_to_string(g)`

Helper to set COLLAPSE columns to nodes and edges dataframe, while converting src, dst, node to dtype(str)  
:type g: Plottable :param g: graphistry instance

**Returns** graphistry instance

`graphistry.compute.collapse.check_has_set(ndf, parent, child)`

`graphistry.compute.collapse.collapse_algo(g, child, parent, attribute, column, seen)`

Basically candy crush over graph properties in a topology aware manner

Checks to see if child node has desired property from parent, we will need to check if (start\_node=parent: has\_attribute , children nodes: has\_attribute) by case (T, T), (F, T), (T, F) and (F, F), we start recursive collapse (or not) on the children, reassigning nodes and edges.

if (T, T), append children nodes to start\_node, re-assign the name of the node, and update the edge table with new name,

if (F, T) start k-(potentially new) super nodes, with k the number of children of start\_node. Start node keeps k outgoing edges.

if (T, F) it is the end of the cluster, and we keep new node as is; keep going

if (F, F); keep going

### Parameters

- **seen** (dict) –
- **g** (Plottable) – graphistry instance
- **child** (Union[str, int]) – child node to start traversal, for first traversal, set child=parent or vice versa.
- **parent** (Union[str, int]) – parent node to start traversal, in main call, this is set to child.
- **attribute** (Union[str, int]) – attribute to collapse by
- **column** (Union[str, int]) – column in nodes dataframe to collapse over.

**Returns** graphistry instance with collapsed nodes.

`graphistry.compute.collapse.collapse_by(self, parent, start_node, attribute, column, seen, self_edges=False, unwrap=False, verbose=True)`

Main call in collapse.py, collapses nodes and edges by attribute, and returns normalized graphistry object.

### Parameters

- **self** (Plottable) – graphistry instance
- **parent** (Union[str, int]) – parent node to start traversal, in main call, this is set to child.
- **start\_node** (Union[str, int]) –
- **attribute** (Union[str, int]) – attribute to collapse by
- **column** (Union[str, int]) – column in nodes dataframe to collapse over.

- **seen** (dict) – dict of previously collapsed pairs – {n1, n2} is seen as different from (n2, n1)
- **verbose** (bool) – bool, default True

:returns graphistry instance with collapsed and normalized nodes.

#### Parameters

- **self\_edges** (bool) –
- **unwrap** (bool) –

**Return type** Plottable

`graphistry.compute.collapse.collapse_nodes_and_edges(g, parent, child)`

Asserts that parent and child node in ndf should be collapsed into super node. Sets new ndf with COLLAPSE nodes in graphistry instance g

# this asserts that we SHOULD merge parent and child as super node # outside logic controls when that is the case # for example, it assumes parent is already in cluster keys of COLLAPSE node

#### Parameters

- **g** (Plottable) – graphistry instance
- **parent** (Union[str, int]) – node with attribute in column
- **child** (Union[str, int]) – node with attribute in column

**Returns** graphistry instance

`graphistry.compute.collapse.get_children(g, node_id, hops=1)`

Helper that gets children at k-hops from node *node\_id*

:returns graphistry instance of hops

#### Parameters

- **g** (Plottable) –
- **node\_id** (Union[str, int]) –
- **hops** (int) –

`graphistry.compute.collapse.get_cluster_store_keys(ndf, node)`

Main innovation in finding and adding to super node. Checks if node is a segment in any collapse\_node in COLLAPSE column of nodes DataFrame

#### Parameters

- **ndf** (DataFrame) – node DataFrame
- **node** (Union[str, int]) – node to find

**Returns** DataFrame of bools of where *wrap\_key(node)* exists in COLLAPSE column

`graphistry.compute.collapse.get_edges_in_out_cluster(g, node_id, attribute, column, directed=True)`

Traverses children of *node\_id* and separates them into incluster and outcluster sets depending if they have *attribute* in node DataFrame *column*

#### Parameters

- **g** (Plottable) – graphistry instance
- **node\_id** (Union[str, int]) – node with attribute in column

- **attribute** (Union[str, int]) – *attribute* to collapse in *column* over
- **column** (Union[str, int]) – *column* to collapse over
- **directed** (bool) –

`graphistry.compute.collapse.get_edges_of_node(g, node_id, outgoing_edges=True, hops=1)`

Gets edges of node at k-hops from node

**Parameters**

- **g** (Plottable) – graphistry instance
- **node\_id** (Union[str, int]) – *node* to find edges from
- **outgoing\_edges** (bool) – bool, if true, finds all outgoing edges of *node*, default True
- **hops** (int) – the number of hops from *node* to take, default = 1

**Returns** DataFrame of edges

`graphistry.compute.collapse.get_new_node_name(ndf, parent, child)`

If child in cluster group, melts name, else makes new parent\_name from parent, child

**Parameters**

- **ndf** (DataFrame) – node DataFrame
- **parent** (Union[str, int]) – *node* with *attribute* in *column*
- **child** (Union[str, int]) – *node* with *attribute* in *column*

:returns new\_parent\_name

**Return type** str

`graphistry.compute.collapse.has_edge(g, n1, n2, directed=True)`

Checks if *n1* and *n2* share an (directed or not) edge

**Parameters**

- **g** (Plottable) – graphistry instance
- **n1** (Union[str, int]) – *node* to check if has edge to *n2*
- **n2** (Union[str, int]) – *node* to check if has edge to *n1*
- **directed** (bool) – bool, if True, checks only outgoing edges from *n1* -> *n2*, else finds undirected edges

**Return type** bool

**Returns** bool, if edge exists between *n1* and *n2*

`graphistry.compute.collapse.has_property(g, ref_node, attribute, column)`

Checks if *ref\_node* is in node dataframe in column with attribute :type attribute: Union[str, int] :param attribute: :type column: Union[str, int] :param column: :type g: Plottable :param g: graphistry instance :type ref\_node: Union[str, int] :param ref\_node: *node* to check if it as *attribute* in *column*

**Return type** bool

**Returns** bool

`graphistry.compute.collapse.in_cluster_store_keys(ndf, node)`

checks if node is in collapse\_node in COLLAPSE column of nodes DataFrame

**Parameters**

- **ndf** (DataFrame) – nodes DataFrame
- **node** (Union[str, int]) – node to find

**Return type** bool

**Returns** bool

`graphistry.compute.collapse.melt(ndf, node)`

Reduces node if in cluster store, otherwise passes it through. ex:

node = “4” will take any sequence from `get_cluster_store_keys`, “1 2 3”, “4 3 6” and returns “1 2 3 4 6” when they have a common entry (3).

:param ndf, node DataFrame :type node: Union[str, int] :param node: node to melt :returns new\_parent\_name of super node

**Parameters** **ndf** (DataFrame) –

**Return type** str

`graphistry.compute.collapse.normalize_graph(g, self_edges=False, unwrap=False)`

Final step after collapse traversals are done, removes duplicates and moves COLLAPSE columns into respective(node, src, dst) columns of node, edges dataframe from Graphistry instance g.

**Parameters**

- **g** (Plottable) – graphistry instance
- **self\_edges** (bool) – bool, whether to keep duplicates from ndf, edf, default False
- **unwrap** (bool) – bool, whether to unwrap node text with ~, default True

**Return type** Plottable

**Returns** final graphistry instance

`graphistry.compute.collapse.reduce_key(key)`

Takes “1 1 2 1 2 3” -> “1 2 3

**Parameters** **key** (Union[str, int]) – node name

**Return type** str

**Returns** new node name with duplicates removed

`graphistry.compute.collapse.unpack(g)`

Helper method that unpacks graphistry instance

ex:

`ndf, edf, src, dst, node = unpack(g)`

**Parameters** **g** (Plottable) – graphistry instance

**Returns** node DataFrame, edge DataFrame, source column, destination column, node column

`graphistry.compute.collapse.unwrap_key(name)`

Unwraps node name: ~name~ -> name

**Parameters** **name** (Union[str, int]) – node to unwrap

**Return type** str

**Returns** unwrapped node name

`graphistry.compute.collapse.wrap_key(name)`

Wraps node name -> ~name~

**Parameters** `name` (Union[str, int]) – node name

**Return type** str

**Returns** wrapped node name

## 3.6 Conditional

**class** graphistry.compute.conditional.**ConditionalMixin** (\*args, \*\*kwargs)

Bases: object

**conditional\_graph** (*x, given, kind='nodes', \*args, \*\*kwargs*)

conditional\_graph –  $p(x|given) = p(x, given) / p(given)$

Useful for finding the conditional probability of a node or edge attribute

returned dataframe sums to 1 on each column

### Parameters

- **x** – target column
- **given** – the dependent column
- **kind** – ‘nodes’ or ‘edges’
- **args/kwags** – additional arguments for `g.bind(...)`

**Returns** a graphistry instance with the conditional graph edges weighted by the conditional probability. edges are between *x* and *given*, keep in mind that `g._edges.columns = [given, x, _probs]`

**conditional\_probs** (*x, given, kind='nodes', how='index'*)

Produces a Dense Matrix of the conditional probability of *x* given *y*

**Args:** *x*: the column variable of interest given the column *y=given* *given*: the variabe to fix constant df  
pd.DataFrame: dataframe *how* (str, optional): One of ‘column’ or ‘index’. Defaults to ‘index’. *kind*  
(str, optional): ‘nodes’ or ‘edges’. Defaults to ‘nodes’.

**Returns:** pd.DataFrame: the conditional probability of *x* given the column *y* as dense array like dataframe

graphistry.compute.conditional.**conditional\_probability** (*x, given, df*)

**conditional probability function over categorical variables**  $p(x | given) = p(x, given)/p(given)$

**Args:** *x*: the column variable of interest given the column ‘given’ *given*: the variabe to fix constant df:  
dataframe with columns [given, x]

**Returns:** pd.DataFrame: the conditional probability of *x* given the column ‘given’

**Parameters** `df` (DataFrame) –

graphistry.compute.conditional.**probs** (*x, given, df, how='index'*)

Produces a Dense Matrix of the conditional probability of *x* given *y=given*

**Args:** *x*: the column variable of interest given the column ‘y’ *given*: the variabe to fix constant df  
pd.DataFrame: dataframe *how* (str, optional): One of ‘column’ or ‘index’. Defaults to ‘index’.

**Returns:** pd.DataFrame: the conditional probability of *x* given the column ‘y’ as dense array like dataframe

**Parameters** `df` (DataFrame) –



## 3.7 Filter by Dictionary

`graphistry.compute.filter_by_dict.filter_by_dict(df, filter_dict=None)`  
 return df where rows match all values in filter\_dict

**Parameters** `filter_dict` (Optional[dict]) –

**Return type** DataFrame

`graphistry.compute.filter_by_dict.filter_edges_by_dict(self, filter_dict)`  
 filter edges to those that match all values in filter\_dict

**Parameters**

- `self` (Plottable) –
- `filter_dict` (dict) –

**Return type** Plottable

`graphistry.compute.filter_by_dict.filter_nodes_by_dict(self, filter_dict)`  
 filter nodes to those that match all values in filter\_dict

**Parameters**

- `self` (Plottable) –
- `filter_dict` (dict) –

**Return type** Plottable

## 3.8 Hop

`graphistry.compute.hop.hop(self, nodes=None, hops=1, to_fixed_point=False, direction='forward', edge_match=None, source_node_match=None, destination_node_match=None, source_node_query=None, destination_node_query=None, edge_query=None, return_as_wave_front=False, target_wave_front=None)`

Given a graph and some source nodes, return subgraph of all paths within k-hops from the sources

`g`: Plotter nodes: dataframe with id column matching `g._node`. None signifies all nodes (default). `hops`: consider paths of length 1 to ‘hops’ steps, if any (default 1). `to_fixed_point`: keep hopping until no new nodes are found (ignores hops) `direction`: ‘forward’, ‘reverse’, ‘undirected’ `edge_match`: dict of kv-pairs to exact match (see also: `filter_edges_by_dict`) `source_node_match`: dict of kv-pairs to match nodes before hopping (including intermediate) `destination_node_match`: dict of kv-pairs to match nodes after hopping (including intermediate) `source_node_query`: dataframe query to match nodes before hopping (including intermediate) `destination_node_query`: dataframe query to match nodes after hopping (including intermediate) `edge_query`: dataframe query to match edges before hopping (including intermediate) `return_as_wave_front`: Only return the nodes/edges reached, ignoring past ones (primarily for internal use) `target_wave_front`: Only consider these nodes for reachability, and for intermediate hops, also consider nodes (primarily for internal use by reverse pass)

**Parameters**

- `self` (Plottable) –
- `nodes` (Optional[DataFrame]) –
- `hops` (Optional[int]) –
- `to_fixed_point` (bool) –

- **direction** (str) -
- **edge\_match** (Optional[dict]) -
- **source\_node\_match** (Optional[dict]) -
- **destination\_node\_match** (Optional[dict]) -
- **source\_node\_query** (Optional[str]) -
- **destination\_node\_query** (Optional[str]) -
- **edge\_query** (Optional[str]) -
- **target\_wave\_front** (Optional[DataFrame]) -

**Return type** Plottable

`graphistry.compute.hop.query_if_not_none(query, df)`

**Parameters**

- **query** (Optional[str]) -
- **df** (DataFrame) -

**Return type** DataFrame

## 3.9 predicates

## 4.1 edge Module

**class** `graphistry.layout.graph.edge.Edge` (*x, y, w=1, data=None, connect=False*)

Bases: `graphistry.layout.graph.edgeBase.EdgeBase`

A graph edge.

### Attributes

- `data` (object): an optional payload
- `w` (int): an optional weight associated with the edge (default 1) used by Dijkstra to find min-flow paths.
- `feedback` (bool): whether the Tarjan algorithm has inverted this edge to de-cycle the graph.

**attach** ()

Attach this edge to the edge collections of the vertices.

**data:** object

**detach** ()

Removes this edge from the edge collections of the vertices.

**feedback:** bool

**w:** int

## 4.2 edgeBase Module

**class** `graphistry.layout.graph.edgeBase.EdgeBase` (*x, y*)

Bases: object

Base class for edges.

### Attributes

- `degree` (int): degree of the edge (number of unique vertices).
- `v` (list[Vertex]): list of vertices associated with this edge.

**degree:** int

Is 0 if a loop, otherwise 1.

## 4.3 graph Module

**class** `graphistry.layout.graph.graph.Graph` (*vertices=None, edges=None, directed=True*)  
Bases: object

**N** (*v, f\_io=0*)

**add\_edge** (*e*)  
add edge e and its vertices into the Graph possibly merging the associated graph\_core components

**add\_edges** (*edges*)  
**Parameters** *edges* (List) –

**add\_vertex** (*v*)  
add vertex v into the Graph as a new component

**component\_class**  
alias of `graphistry.layout.graph.graphBase.GraphBase`

**connected** ()  
returns the list of components

**deg\_avg** ()  
the average degree of vertices

**deg\_max** ()  
the maximum degree of vertices

**deg\_min** ()  
the minimum degree of vertices

**edges** ()

**eps** ()  
the graph epsilon value (norm/order), average number of edges per vertex.

**get\_vertex\_from\_data** (*data*)

**get\_vertices\_count** ()

**norm** ()  
the norm of the graph (number of edges)

**order** ()  
the order of the graph (number of vertices)

**path** (*x, y, f\_io=0, hook=None*)

**remove\_edge** (*e*)  
remove edge e possibly spawning two new cores if the graph\_core that contained e gets disconnected.

**remove\_vertex** (*x*)  
remove vertex v and all its edges.

**vertices** ()  
see graph\_core

## 4.4 graphBase Module

**class** graphistry.layout.graph.graphBase.**GraphBase** (*vertices=None, edges=None, directed=True*)

Bases: object

A connected graph of Vertex/Edge objects. A GraphBase is a *component* of a Graph that contains a connected set of Vertex and Edges.

**Attributes:** verticesPoset (Poset[Vertex]): the partially ordered set of vertices of the graph. edgesPoset (Poset[Edge]): the partially ordered set of edges of the graph. loops (set[Edge]): the set of *loop* edges (of degree 0). directed (bool): indicates if the graph is considered *oriented* or not.

**N** (*v, f\_io=0*)

**add\_edge** (*e*)

add edge e. At least one of its vertex must belong to the graph, the other being added automatically.

**add\_single\_vertex** (*v*)

allow a GraphBase to hold a single vertex.

**complement** (*G*)

**constant\_function** (*value*)

**contract** (*e*)

**deg\_avg** ()

the average degree of vertices

**deg\_max** ()

the maximum degree of vertices

**deg\_min** ()

the minimum degree of vertices

**dft** (*start\_vertex=None*)

**dijkstra** (*x, f\_io=0, hook=None*)

shortest weighted-edges paths between x and all other vertices by dijkstra's algorithm with heap used as priority queue.

**edges** (*cond=None*)

generates an iterator over edges, with optional filter

**eps** ()

the graph epsilon value (norm/order), average number of edges per vertex.

**get\_scs\_with\_feedback** (*roots=None*)

Minimum FAS algorithm (feedback arc set) creating a DAG. Returns the set of strongly connected components ("scs") by using Tarjan algorithm. These are maximal sets of vertices such that there is a path from each vertex to every other vertex. The algorithm performs a DFS from the provided list of root vertices. A cycle is of course a strongly connected component, but a strongly connected component can include several cycles. The Feedback Acyclic Set of edge to be removed/reversed is provided by marking the edges with a "feedback" flag. Complexity is  $O(V+E)$ .

**Parameters roots** –

**Returns**

**leaves** ()

returns the list of *leaves* (vertices with no outward edges).

**matrix** (*cond=None*)

This associativity matrix is like the adjacency matrix but antisymmetric. Returns the associativity matrix of the graph component

**Parameters** **cond** – same as the condition function in `vertices()`.

**Returns** array

**norm** ()

The size of the edge poset (number of edges).

**order** ()

the order of the graph (number of vertices)

**partition** ()

**path** (*x, y, f\_io=0, hook=None*)

shortest path between vertices *x* and *y* by breadth-first descent, constrained by *f\_io* direction if provided. The path is returned as a list of `Vertex` objects. If a *hook* function is provided, it is called at every vertex added to the path, passing the vertex object as argument.

**remove\_edge** (*e*)

remove Edge *e*, asserting that the resulting graph is still connex.

**remove\_vertex** (*x*)

remove Vertex *x* and all associated edges.

**roots** ()

returns the list of *roots* (vertices with no inward edges).

**spans** (*vertices*)

**union\_update** (*G*)

**vertices** (*cond=None*)

generates an iterator over vertices, with optional filter

## 4.5 vertex Module

**class** `graphistry.layout.graph.vertex.Vertex` (*data=None*)

Bases: `graphistry.layout.graph.vertexBase.VertexBase`

Vertex class enhancing a `VertexBase` with graph-related features.

**Attributes** **component** (`GraphBase`): the component of connected vertices that contains this vertex. By default, a vertex belongs no component but when it is added in a graph, *c* points to the connected component in this graph. **data** (`object`): an object associated with the vertex.

**property** **index**

## 4.6 vertexBase Module

**class** graphistry.layout.graph.vertexBase.**VertexBase**

Bases: object

Base class for vertices.

**Attributes** e (list[Edge]): list of edges associated with this vertex.

**degree** ()

degree(): degree of the vertex (number of edges).

**detach** ()

removes this vertex from all its edges and returns this list of edges.

**e\_dir** (dir)

either e\_in, e\_out or all edges depending on provided direction parameter (>0 means outward).

**e\_from** (x)

returns the Edge from vertex v directed toward this vertex.

**e\_in** ()

e\_in(): list of edges directed toward this vertex.

**e\_out** ()

e\_out(): list of edges directed outward this vertex.

**e\_to** (y)

returns the Edge from this vertex directed toward vertex v.

**e\_with** (v)

return the Edge with both this vertex and vertex v

**neighbors** (direction=0)

Returns the neighbors of this vertex. List of neighbor vertices in all directions (default) or in filtered f\_io direction (>0 means outward).

**Parameters direction** –

- 0: parent and children
- -1: parents
- +1: children

**Returns** list of vertices

## 4.7 Module contents





## FEATURIZE

```
class graphistry.feature_utils.Embedding (df)
```

```
Bases: object
```

Generates random embeddings of a given dimension that aligns with the index of the dataframe

**Parameters** *df* (DataFrame) –

```
fit (n_dim)
```

**Parameters** *n\_dim* (int) –

```
fit_transform (n_dim)
```

**Parameters** *n\_dim* (int) –

```
transform (ids)
```

**Return type** DataFrame

```
class graphistry.feature_utils.FastEncoder (df, y=None, kind='nodes')
```

```
Bases: object
```

```
fit (src=None, dst=None, *args, **kwargs)
```

```
fit_transform (src=None, dst=None, *args, **kwargs)
```

```
scale (X=None, y=None, return_pipeline=False, *args, **kwargs)
```

Fits new scaling functions on df, y via args-kwargs

**Example:**

```
from graphistry.features import SCALERS, SCALER_OPTIONS
print (SCALERS)
g = graphistry.nodes (df)
# set a scaling strategy for features and targets -- umap uses those and_
↳ produces different results depending.
g2 = g.umap (use_scaler='standard', use_scaler_target=None)

# later if you want to scale new data, you can do so
X, y = g2.transform (df, df, scaled=False) # unscaled transformer output
# now scale with new settings
X_scaled, y_scaled = g2.scale (X, y, use_scaler='minmax', use_scaler_
↳ target='kbins', n_bins=5)
# fit some other pipeline
clf.fit (X_scaled, y_scaled)
```

args:

```

;X: pd.DataFrame of features
;y: pd.DataFrame of target features
:kind: str, one of 'nodes' or 'edges'
*args, **kwargs: passed to smart_scaler pipeline
    
```

**returns:** scaled X, y

**transform** (*df*, *ydf=None*)

Raw transform, no scaling.

**transform\_scaled** (*df*, *ydf=None*, *scaling\_pipeline=None*, *scaling\_pipeline\_target=None*)

**class** graphistry.feature\_utils.**FastMLB** (*mlb*, *in\_column*, *out\_columns*)

Bases: object

**fit** (*X*, *y=None*)

**get\_feature\_names\_in** ()

**get\_feature\_names\_out** ()

**transform** (*df*)

**class** graphistry.feature\_utils.**FeatureMixin** (*\*args*, *\*\*kwargs*)

Bases: object

FeatureMixin for automatic featurization of nodes and edges DataFrames. Subclasses UMAPMixin for umap-ing of automatic features.

Usage:

```

g = graphistry.nodes(df, 'node_column')
g2 = g.featurize()
    
```

or for edges,

```

g = graphistry.edges(df, 'src', 'dst')
g2 = g.featurize(kind='edges')
    
```

or chain them for both nodes and edges,

```

g = graphistry.edges(edf, 'src', 'dst').nodes(ndf, 'node_column')
g2 = g.featurize().featurize(kind='edges')
    
```

**featurize** (*kind='nodes'*, *X=None*, *y=None*, *use\_scaler=None*, *use\_scaler\_target=None*, *cardinality\_threshold=40*, *cardinality\_threshold\_target=400*, *n\_topics=42*, *n\_topics\_target=12*, *multilabel=False*, *embedding=False*, *use\_ngrams=False*, *ngram\_range=(1, 3)*, *max\_df=0.2*, *min\_df=3*, *min\_words=4.5*, *model\_name='paraphrase-MiniLM-L6-v2'*, *impute=True*, *n\_quantiles=100*, *output\_distribution='normal'*, *quantile\_range=(25, 75)*, *n\_bins=10*, *encode='ordinal'*, *strategy='uniform'*, *similarity=None*, *categories='auto'*, *keep\_n\_decimals=5*, *remove\_node\_column=True*, *inplace=False*, *feature\_engine='auto'*, *dbscan=False*, *min\_dist=0.5*, *min\_samples=1*, *memoize=True*, *verbose=False*)

Featurize Nodes or Edges of the underlying nodes/edges DataFrames.

### Parameters

- **kind** (`str`) – specify whether to featurize *nodes* or *edges*. Edge featurization includes a pairwise src-to-dst feature block using a MultiLabelBinarizer, with any other columns being treated the same way as with *nodes* featurization.

- **x** (Union[List[str], str, DataFrame, None]) – Optional input, default None. If symbolic, evaluated against self data based on kind. If None, will featurize all columns of DataFrame
- **y** (Union[List[str], str, DataFrame, None]) – Optional Target(s) columns or explicit DataFrame, default None
- **use\_scaler** (Optional[str]) – selects which scaler (and automatically imputes missing values using mean strategy) to scale the data. Options are; “minmax”, “quantile”, “standard”, “robust”, “kbins”, default None. Please see scikits-learn documentation <https://scikit-learn.org/stable/modules/preprocessing.html> Here ‘standard’ corresponds to ‘StandardScaler’ in scikits.
- **cardinality\_threshold** (int) – dirty\_cat threshold on cardinality of categorical labels across columns. If value is greater than threshold, will run GapEncoder (a topic model) on column. If below, will one-hot\_encode. Default 40.
- **cardinality\_threshold\_target** (int) – similar to cardinality\_threshold, but for target features. Default is set high (400), as targets generally want to be one-hot encoded, but sometimes it can be useful to use GapEncoder (ie, set threshold lower) to create regressive targets, especially when those targets are textual/softly categorical and have semantic meaning across different labels. Eg, suppose a column has fields like [‘Application Fraud’, ‘Other Statuses’, ‘Lost-Target scaling using/Stolen Fraud’, ‘Investigation Fraud’, ...] the GapEncoder will concentrate the ‘Fraud’ labels together.
- **n\_topics** (int) – the number of topics to use in the GapEncoder if cardinality\_thresholds is saturated. Default is 42, but good rule of thumb is to consult the Johnson-Lindenstrauss Lemma [https://en.wikipedia.org/wiki/Johnson%E2%80%93Lindenstrauss\\_lemma](https://en.wikipedia.org/wiki/Johnson%E2%80%93Lindenstrauss_lemma) or use the simplified *random walk* estimate =>  $n\_topics\_lower\_bound \sim (\pi/2) * (N - documents)^{1/4}$
- **n\_topics\_target** (int) – the number of topics to use in the GapEncoder if cardinality\_thresholds\_target is saturated for the target(s). Default 12.
- **min\_words** (float) – sets threshold on how many words to consider in a textual column if it is to be considered in the text processing pipeline. Set this very high if you want any textual columns to bypass the transformer, in favor of GapEncoder (topic modeling). Set to 0 to force all named columns to be encoded as textual (embedding)
- **model\_name** (str) – Sentence Transformer model to use. Default Paraphrase model makes useful vectors, but at cost of encoding time. If faster encoding is needed, *average\_word\_embeddings\_komninos* is useful and produces less semantically relevant vectors. Please see sentence\_transformer (<https://www.sbert.net/>) library for all available models.
- **multilabel** (bool) – if True, will encode a *single* target column composed of lists of lists as multilabel outputs. This only works with y=[‘a\_single\_col’], default False
- **embedding** (bool) – If True, produces a random node embedding of size *n\_topics* default, False. If no node features are provided, will produce random embeddings (for GNN models, for example)
- **use\_ngrams** (bool) – If True, will encode textual columns as TfIdf Vectors, default, False.
- **ngram\_range** (tuple) – if use\_ngrams=True, can set ngram\_range, eg: tuple = (1, 3)
- **max\_df** (float) – if use\_ngrams=True, set max word frequency to consider in vocabulary eg: max\_df = 0.2,

- **min\_df** (int) – if use\_ngrams=True, set min word count to consider in vocabulary eg: min\_df = 3 or 0.00001
- **categories** (Optional[str]) – Optional[str] in [“auto”, “k-means”, “most\_frequent”], decides which category to select in Similarity Encoding, default ‘auto’
- **impute** (bool) – Whether to impute missing values, default True
- **n\_quantiles** (int) – if use\_scaler = ‘quantile’, sets the quantile bin size.
- **output\_distribution** (str) – if use\_scaler = ‘quantile’, can return distribution as [“normal”, “uniform”]
- **quantile\_range** – if use\_scaler = ‘robust|’quantile’, sets the quantile range.
- **n\_bins** (int) – number of bins to use in kbins discretizer, default 10
- **encode** (str) – encoding for KBinsDiscretizer, can be one of *onehot*, *onehot-dense*, *ordinal*, default ‘ordinal’
- **strategy** (str) – strategy for KBinsDiscretizer, can be one of *uniform*, *quantile*, *kmeans*, default ‘quantile’
- **n\_quantiles** – if use\_scaler = “quantile”, sets the number of quantiles, default=100
- **output\_distribution** – if use\_scaler=”quantile|”robust”, choose from [“normal”, “uniform”]
- **dbscan** (bool) – whether to run DBSCAN, default False.
- **min\_dist** (float) – DBSCAN eps parameter, default 0.5.
- **min\_samples** (int) – DBSCAN min\_samples parameter, default 5.
- **keep\_n\_decimals** (int) – number of decimals to keep
- **remove\_node\_column** (bool) – whether to remove node column so it is not featurized, default True.
- **inplace** (bool) – whether to not return new graphistry instance or not, default False.
- **memoize** (bool) – whether to store and reuse results across runs, default True.
- **use\_scaler\_target** (Optional[str]) –
- **similarity** (Optional[str]) –
- **feature\_engine** (Literal[‘none’, ‘pandas’, ‘dirty\_cat’, ‘torch’, ‘auto’]) –
- **verbose** (bool) –

**Returns** graphistry instance with new attributes set by the featurization process.

**get\_matrix** (columns=None, kind='nodes', target=False)

Returns feature matrix, and if columns are specified, returns matrix with only the columns that contain the string *column\_part* in their name. `X = g.get_matrix(['feature1', 'feature2'])` will retrieve a feature matrix with only the columns that contain the string *feature1* or *feature2* in their name. Most useful for topic modeling, where the column names are of the form *topic\_0: descriptor*, *topic\_1: descriptor*, etc. Can retrieve unique columns in original dataframe, or actual topic features like [ip\_part, shoes, preference\_x, etc]. Powerful way to retrieve features from a featurized graph by column or (top) features of interest.

**Example:**

```

# get the full feature matrices
X = g.get_matrix()
y = g.get_matrix(target=True)

# get subset of features, or topics, given topic model encoding
X = g2.get_matrix(['172', 'percent'])
X.columns
=> ['ip_172.56.104.67', 'ip_172.58.129.252', 'item_percent']
# or in targets
y = g2.get_matrix(['total', 'percent'], target=True)
y.columns
=> ['basket_price_total', 'conversion_percent', 'CTR_percent',
↪ 'CVR_percent']

# not as useful for sbert features.

```

**Caveats:**

- if you have a column name that is a substring of another column name, you may get unexpected results.

**Args:**

**columns** (Union[List, str]) list of column names or a single column name that may exist in columns of the feature matrix. If None, returns original feature matrix

**kind** (str, optional) Node or Edge features. Defaults to 'nodes'.

**target** (bool, optional) If True, returns the target matrix. Defaults to False.

**Returns:** pd.DataFrame: feature matrix with only the columns that contain the string *column\_part* in their name.

**Parameters**

- **columns** (Union[List, str, None]) –
- **kind** (str) –
- **target** (bool) –

**Return type** DataFrame

**scale** (df=None, y=None, kind='nodes', use\_scaler=None, use\_scaler\_target=None, impute=True, n\_quantiles=10, output\_distribution='normal', quantile\_range=(25, 75), n\_bins=10, encode='ordinal', strategy='uniform', keep\_n\_decimals=5, return\_scalers=False)  
Scale data using the same scalers as used in the featurization step.

**Example**

```

g = graphistry.nodes(df)
X, y = g.featurize().scale(kind='nodes', use_scaler='robust', use_scaler_
↪target='kbins', n_bins=3)

# or
g = graphistry.nodes(df)
# set a scaling strategy for features and targets -- umap uses those and_
↪produces different results depending.
g2 = g.umap(use_scaler='standard', use_scaler_target=None)

```

(continues on next page)

(continued from previous page)

```

# later if you want to scale new data, you can do so
X, y = g2.transform(df, df, scale=False)
X_scaled, y_scaled = g2.scale(X, y, use_scaler='minmax', use_scaler_target=
→'kbins', n_bins=5)
# fit some other pipeline
clf.fit(X_scaled, y_scaled)

```

**Args:**

- df** pd.DataFrame, raw data to transform, if None, will use data from featurization fit
- y** pd.DataFrame, optional target data
- kind** str, one of *nodes*, *edges*
- use\_scaler** str, optional, one of *minmax*, *robust*, *standard*, *kbins*, *quantile*
- use\_scaler\_target** str, optional, one of *minmax*, *robust*, *standard*, *kbins*, *quantile*
- impute** bool, if True, will impute missing values
- n\_quantiles** int, number of quantiles to use for quantile scaler
- output\_distribution** str, one of *normal*, *uniform*, *lognormal*
- quantile\_range** tuple, range of quantiles to use for quantile scaler
- n\_bins** int, number of bins to use for KBinsDiscretizer
- encode** str, one of *ordinal*, *onehot*, *onehot-dense*, *binary*
- strategy** str, one of *uniform*, *quantile*, *kmeans*
- keep\_n\_decimals** int, number of decimals to keep after scaling
- return\_scalers** bool, if True, will return the scalers used to scale the data

**Returns:**

(X, y) transformed data if return\_graph is False or a graph with inferred edges if return\_graph is True, or (X, y, scaler, scaler\_target) if return\_scalers is True

**Parameters**

- **df** (Optional[DataFrame]) –
- **y** (Optional[DataFrame]) –
- **kind** (str) –
- **use\_scaler** (Optional[str]) –
- **use\_scaler\_target** (Optional[str]) –
- **impute** (bool) –
- **n\_quantiles** (int) –
- **output\_distribution** (str) –
- **n\_bins** (int) –
- **encode** (str) –
- **strategy** (str) –

- **keep\_n\_decimals** (int) –
- **return\_scalers** (bool) –

**transform** (*df*, *y=None*, *kind='nodes'*, *min\_dist='auto'*, *n\_neighbors=7*, *merge\_policy=False*, *sample=None*, *return\_graph=True*, *scaled=True*, *verbose=False*)  
 Transform new data and append to existing graph, or return dataframes

**args:**

**df** pd.DataFrame, raw data to transform

**ydf** pd.DataFrame, optional

**kind** str # one of *nodes*, *edges*

**return\_graph** bool, if True, will return a graph with inferred edges.

**merge\_policy** bool, if True, adds batch to existing graph nodes via nearest neighbors. If False, will infer edges only between nodes in the batch, default False

**min\_dist** float, if return\_graph is True, will use this value in NN search, or 'auto' to infer a good value. min\_dist represents the maximum distance between two samples for one to be considered as in the neighborhood of the other.

**sample** int, if return\_graph is True, will use sample edges of existing graph to fill out the new graph

**n\_neighbors** int, if return\_graph is True, will use this value for n\_neighbors in Nearest Neighbors search

**scaled** bool, if True, will use scaled transformation of data set during featurization, default True

**verbose** bool, if True, will print metadata about the graph construction, default False

**Returns:**

X, y: pd.DataFrame, transformed data if return\_graph is False or a graphistry Plottable with inferred edges if return\_graph is True

**Parameters**

- **df** (DataFrame) –
- **y** (Optional[DataFrame]) –
- **kind** (str) –
- **min\_dist** (Union[str, float, int]) –
- **n\_neighbors** (int) –
- **merge\_policy** (bool) –
- **sample** (Optional[int]) –
- **return\_graph** (bool) –
- **scaled** (bool) –
- **verbose** (bool) –

graphistry.feature\_utils.assert\_imported()

graphistry.feature\_utils.assert\_imported\_text()

**class** graphistry.feature\_utils.**callThrough** (*x*)

Bases: object

graphistry.feature\_utils.**check\_if\_textual\_column** (*df*, *col*, *confidence=0.35*,  
*min\_words=2.5*)

Checks if *col* column of *df* is textual or not using basic heuristics

**Parameters**

- **df** (DataFrame) – DataFrame
- **col** – column name
- **confidence** (float) – threshold float value between 0 and 1. If column *col* has *confidence* more elements as type *str* it will pass it onto next stage of evaluation. Default 0.35
- **min\_words** (float) – mean minimum words threshold. If mean words across *col* is greater than this, it is deemed textual. Default 2.5

**Return type** bool

**Returns** bool, whether column is textual or not

graphistry.feature\_utils.**concat\_text** (*df*, *text\_cols*)

graphistry.feature\_utils.**encode\_edges** (*edf*, *src*, *dst*, *mlb*, *fit=False*)

edge encoder – creates multilabelBinarizer on edge pairs.

**Args:** *edf* (pd.DataFrame): edge dataframe *src* (string): source column *dst* (string): destination column *mlb* (sklearn): multilabelBinarizer *fit* (bool, optional): If true, fits multilabelBinarizer. Defaults to False.

**Returns** tuple: pd.DataFrame, multilabelBinarizer

graphistry.feature\_utils.**encode\_multi\_target** (*ydf*, *mlb=None*)

graphistry.feature\_utils.**encode\_textual** (*df*, *min\_words=2.5*, *model\_name='paraphrase-MiniLM-L6-v2'*,  
*use\_ngrams=False*,  
*ngram\_range=(1, 3)*, *max\_df=0.2*, *min\_df=3*)

**Parameters**

- **df** (DataFrame) –
- **min\_words** (float) –
- **model\_name** (str) –
- **use\_ngrams** (bool) –
- **ngram\_range** (tuple) –
- **max\_df** (float) –
- **min\_df** (int) –

**Return type** Tuple[DataFrame, List, Any]

graphistry.feature\_utils.**features\_without\_target** (*df*, *y=None*)

Checks if *y* DataFrame column name is in *df*, and removes it from *df* if so

**Parameters**

- **df** (DataFrame) – model DataFrame
- **y** (Union[List, str, DataFrame, None]) – target DataFrame

**Return type** DataFrame



**Returns** DataFrames of model and target

`graphistry.feature_utils.find_bad_set_columns(df, bad_set=[''])`  
 Finds columns that if not coerced to strings, will break processors.

**Parameters**

- **df** (DataFrame) – DataFrame
- **bad\_set** (List) – List of strings to look for.

**Returns** list

`graphistry.feature_utils.fit_pipeline(X, transformer, keep_n_decimals=5)`  
 Helper to fit DataFrame over transformer pipeline. Rounds resulting matrix X by keep\_n\_digits if not 0, which helps for when transformer pipeline is scaling or imputer which sometime introduce small negative numbers, and umap metrics like Hellinger need to be positive :type X: DataFrame :param X: DataFrame to transform. :param transformer: Pipeline object to fit and transform :type keep\_n\_decimals: int :param keep\_n\_decimals: Int of how many decimal places to keep in rounded transformed data

**Return type** DataFrame

`graphistry.feature_utils.get_cardinality_ratio(df)`  
 Calculates the ratio of unique values to total number of rows of DataFrame

**Parameters** **df** (DataFrame) – DataFrame

`graphistry.feature_utils.get_dataframe_by_column_dtype(df, include=None, exclude=None)`

`graphistry.feature_utils.get_matrix_by_column_part(X, column_part)`  
 Get the feature matrix by column part existing in column names.

**Parameters**

- **X** (DataFrame) –
- **column\_part** (str) –

**Return type** DataFrame

`graphistry.feature_utils.get_matrix_by_column_parts(X, column_parts)`  
 Get the feature matrix by column parts list existing in column names.

**Parameters**

- **X** (DataFrame) –
- **column\_parts** (Union[list, str, None]) –

**Return type** DataFrame

`graphistry.feature_utils.get_numeric_transformers(ndf, y=None)`

`graphistry.feature_utils.get_preprocessing_pipeline(use_scaler='robust', impute=True, n_quantiles=10, output_distribution='normal', quantile_range=(25, 75), n_bins=10, encode='ordinal', strategy='quantile')`

Helper function for imputing and scaling np.ndarray data using different scaling transformers.

**Parameters**

- **X** – np.ndarray
- **impute** (bool) – whether to run imputing or not

- **use\_scaler** (str) – string in None or [“minmax”, “quantile”, “standard”, “robust”, “kbins”], selects scaling transformer, default None
- **n\_quantiles** (int) – if use\_scaler = ‘quantile’, sets the quantile bin size.
- **output\_distribution** (str) – if use\_scaler = ‘quantile’, can return distribution as [“normal”, “uniform”]
- **quantile\_range** – if use\_scaler = ‘robust’/‘quantile’, sets the quantile range.
- **n\_bins** (int) – number of bins to use in kbins discretizer
- **encode** (str) – encoding for KBinsDiscretizer, can be one of *onehot*, *onehot-dense*, *ordinal*, default ‘ordinal’
- **strategy** (str) – strategy for KBinsDiscretizer, can be one of *uniform*, *quantile*, *kmeans*, default ‘quantile’

**Return type** Any

**Returns** scaled array, imputer instances or None, scaler instance or None

```
graphistry.feature_utils.get_text_preprocessor(ngram_range=(1, 3), max_df=0.2, min_df=3)
```

```
graphistry.feature_utils.get_textual_columns(df, min_words=2.5)
```

Collects columns from df that it deems are textual.

**Parameters**

- **df** (DataFrame) – DataFrame
- **min\_words** (float) –

**Return type** List

**Returns** list of columns names

```
graphistry.feature_utils.group_columns_by_dtypes(df, verbose=True)
```

**Parameters**

- **df** (DataFrame) –
- **verbose** (bool) –

**Return type** Dict

```
graphistry.feature_utils.identity(x)
```

```
graphistry.feature_utils.impute_and_scale_df(df, use_scaler='robust', impute=True, n_quantiles=10, output_distribution='normal', quantile_range=(25, 75), n_bins=10, encode='ordinal', strategy='uniform', keep_n_decimals=5)
```

**Parameters**

- **df** (DataFrame) –
- **use\_scaler** (str) –
- **impute** (bool) –
- **n\_quantiles** (int) –
- **output\_distribution** (str) –

- **n\_bins** (int) –
- **encode** (str) –
- **strategy** (str) –
- **keep\_n\_decimals** (int) –

**Return type** Tuple[DataFrame, Any]

graphistry.feature\_utils.**is\_dataframe\_all\_numeric** (df)

**Parameters** df (DataFrame) –

**Return type** bool

graphistry.feature\_utils.**lazy\_import\_has\_dependency\_text** ()

graphistry.feature\_utils.**lazy\_import\_has\_min\_dependency** ()

graphistry.feature\_utils.**make\_array** (X)

graphistry.feature\_utils.**passthrough\_df\_cols** (df, columns)

graphistry.feature\_utils.**process\_dirty\_dataframes** (ndf, y, cardinality\_threshold=40, cardinality\_threshold\_target=400, n\_topics=42, n\_topics\_target=7, similarity=None, categories='auto', multilabel=False)

Dirty\_Cat encoder for record level data. Will automatically turn inhomogeneous dataframe into matrix using smart conversion tricks.

#### Parameters

- **ndf** (DataFrame) – node DataFrame
- **y** (Optional[DataFrame]) – target DataFrame or series
- **cardinality\_threshold** (int) – For ndf columns, below this threshold, encoder is OneHot, above, it is GapEncoder
- **cardinality\_threshold\_target** (int) – For target columns, below this threshold, encoder is OneHot, above, it is GapEncoder
- **n\_topics** (int) – number of topics for GapEncoder, default 42
- **use\_scaler** – None or string in ['minmax', 'standard', 'robust', 'quantile']
- **similarity** (Optional[str]) – one of 'ngram', 'levenshtein-ratio', 'jaro', or 'jaro-winkler'}) – The type of pairwise string similarity to use. If None or False, uses a SuperVectorizer
- **n\_topics\_target** (int) –
- **categories** (Optional[str]) –
- **multilabel** (bool) –

**Return type** Tuple[DataFrame, Optional[DataFrame], Any, Any]

**Returns** Encoded data matrix and target (if not None), the data encoder, and the label encoder.

```
graphistry.feature_utils.process_edge_dataframes(edf, y, src, dst, cardinal-  
ity_threshold=40, cardinal-  
ity_threshold_target=400,  
n_topics=42, n_topics_target=7,  
use_scaler=None,  
use_scaler_target=None, multil-  
abel=False, use_ngrams=False,  
ngram_range=(1, 3), max_df=0.2,  
min_df=3, min_words=2.5,  
model_name='paraphrase-  
MiniLM-L6-v2', similar-  
ity=None, categories='auto',  
impute=True, n_quantiles=10,  
output_distribution='normal',  
quantile_range=(25, 75),  
n_bins=10, encode='ordinal', strat-  
egy='uniform', keep_n_decimals=5,  
feature_engine='pandas')
```

Custom Edge-record encoder. Uses a MultiLabelBinarizer to generate a src/dst vector and then process\_textual\_or\_other\_dataframes that encodes any other data present in edf, textual or not.

#### Parameters

- **edf** (DataFrame) – pandas DataFrame of edge features
- **y** (DataFrame) – pandas DataFrame of edge labels
- **src** (str) – source column to select in edf
- **dst** (str) – destination column to select in edf
- **use\_scaler** (Optional[str]) – None or string in ['minmax', 'standard', 'robust', 'quantile']
- **cardinality\_threshold** (int) –
- **cardinality\_threshold\_target** (int) –
- **n\_topics** (int) –
- **n\_topics\_target** (int) –
- **use\_scaler\_target** (Optional[str]) –
- **multilabel** (bool) –
- **use\_ngrams** (bool) –
- **ngram\_range** (tuple) –
- **max\_df** (float) –
- **min\_df** (int) –
- **min\_words** (float) –
- **model\_name** (str) –
- **similarity** (Optional[str]) –
- **categories** (Optional[str]) –
- **impute** (bool) –

- **n\_quantiles** (int) –
- **output\_distribution** (str) –
- **n\_bins** (int) –
- **encode** (str) –
- **strategy** (str) –
- **keep\_n\_decimals** (int) –
- **feature\_engine** (Literal['none', 'pandas', 'dirty\_cat', 'torch']) –

**Return type** Tuple[DataFrame, DataFrame, DataFrame, DataFrame, List[Any], Any, Optional[Any], Optional[Any], Any, List[str]]

**Returns** Encoded data matrix and target (if not None), the data encoders, and the label encoder.

```
graphistry.feature_utils.process_nodes_dataframes(df, y, cardinality_threshold=40,
                                                cardinality_threshold_target=400,
                                                n_topics=42, n_topics_target=7,
                                                use_scaler='robust',
                                                use_scaler_target='kbins',
                                                multilabel=False, embedding=False,
                                                use_ngrams=False, ngram_range=(1, 3),
                                                max_df=0.2, min_df=3, min_words=2.5,
                                                model_name='paraphrase-MiniLM-L6-v2',
                                                similarity=None, categories='auto',
                                                impute=True, n_quantiles=10,
                                                output_distribution='normal',
                                                quantile_range=(25, 75),
                                                n_bins=10, encode='ordinal',
                                                strategy='uniform', keep_n_decimals=5,
                                                feature_engine='pandas')
```

Automatic Deep Learning Embedding/ngrams of Textual Features, with the rest of the columns taken care of by dirty\_cat

#### Parameters

- **df** (DataFrame) – pandas DataFrame of data
- **y** (DataFrame) – pandas DataFrame of targets
- **use\_scaler** (Optional[str]) – None or string in ['minmax', 'standard', 'robust', 'quantile']
- **n\_topics** (int) – number of topics in Gap Encoder
- **use\_scaler** –
- **confidence** – Number between 0 and 1, will pass column for textual processing if total entries are string like in a column and above this relative threshold.
- **min\_words** (float) – Sets the threshold for average number of words to include column for textual sentence encoding. Lower values means that columns will be labeled textual and sent to sentence-encoder. Set to 0 to force named columns as textual.
- **model\_name** (str) – SentenceTransformer model name. See available list at [https://www.sbert.net/docs/pretrained\\_models.html#sentence-embedding-models](https://www.sbert.net/docs/pretrained_models.html#sentence-embedding-models)

- **cardinality\_threshold** (int) -
- **cardinality\_threshold\_target** (int) -
- **n\_topics\_target** (int) -
- **use\_scaler\_target** (Optional[str]) -
- **multilabel** (bool) -
- **embedding** (bool) -
- **use\_ngrams** (bool) -
- **ngram\_range** (tuple) -
- **max\_df** (float) -
- **min\_df** (int) -
- **similarity** (Optional[str]) -
- **categories** (Optional[str]) -
- **impute** (bool) -
- **n\_quantiles** (int) -
- **output\_distribution** (str) -
- **n\_bins** (int) -
- **encode** (str) -
- **strategy** (str) -
- **keep\_n\_decimals** (int) -
- **feature\_engine** (Literal['none', 'pandas', 'dirty\_cat', 'torch']) -

**Return type** Tuple[DataFrame, Any, DataFrame, Any, Any, Any, Optional[Any], Optional[Any], Any, List[str]]

**Returns** X\_enc, y\_enc, data\_encoder, label\_encoder, scaling\_pipeline, scaling\_pipeline\_target, text\_model, text\_cols,

graphistry.feature\_utils.**prune\_weighted\_edges\_df\_and\_relabel\_nodes** (*wdf*,  
*scale=0.1*,  
*in-*  
*dex\_to\_nodes\_dict=None*)

Prune the weighted edge DataFrame so to return high fidelity similarity scores.

**Parameters**

- **wdf** (DataFrame) - weighted edge DataFrame gotten via UMAP
- **scale** (float) - lower values means less edges > (max - scale \* std)
- **index\_to\_nodes\_dict** (Optional[Dict]) - dict of index to node name; remap src/dst values if provided

**Return type** DataFrame

**Returns** pd.DataFrame

graphistry.feature\_utils.**remove\_internal\_namespace\_if\_present** (*df*)

Some tranformations below add columns to the DataFrame, this method removes them before featurization Will not drop if suffix is added during UMAP-ing

**Parameters** `df` (DataFrame) – DataFrame

**Returns** DataFrame with dropped columns in reserved namespace

`graphistry.feature_utils.remove_node_column_from_symbolic` (*X\_symbolic*, *node*)

`graphistry.feature_utils.resolve_X` (*df*, *X*)

**Parameters**

- **df** (Optional[DataFrame]) –
- **x** (Union[List[str], str, DataFrame, None]) –

**Return type** DataFrame

`graphistry.feature_utils.resolve_feature_engine` (*feature\_engine*)

**Parameters** **feature\_engine** (Literal['none', 'pandas', 'dirty\_cat', 'torch', 'auto']) –

**Return type** Literal['none', 'pandas', 'dirty\_cat', 'torch']

`graphistry.feature_utils.resolve_y` (*df*, *y*)

**Parameters**

- **df** (Optional[DataFrame]) –
- **y** (Union[List[str], str, DataFrame, None]) –

**Return type** DataFrame

`graphistry.feature_utils.reuse_featurization` (*g*, *memoize*, *metadata*)

**Parameters**

- **g** (Plottable) –
- **memoize** (bool) –
- **metadata** (Any) –

`graphistry.feature_utils.safe_divide` (*a*, *b*)

`graphistry.feature_utils.set_currency_to_float` (*df*, *col*, *return\_float=True*)

**Parameters**

- **df** (DataFrame) –
- **col** (str) –
- **return\_float** (bool) –

`graphistry.feature_utils.set_to_bool` (*df*, *col*, *value*)

**Parameters**

- **df** (DataFrame) –
- **col** (str) –
- **value** (Any) –

`graphistry.feature_utils.set_to_datetime` (*df*, *cols*, *new\_col*)

**Parameters**

- **df** (DataFrame) –
- **cols** (List) –

- **new\_col** (str) –

`graphistry.feature_utils.set_to_numeric(df, cols, fill_value=0.0)`

**Parameters**

- **df** (DataFrame) –
- **cols** (List) –
- **fill\_value** (float) –

`graphistry.feature_utils.smart_scaler(X_enc, y_enc, use_scaler, use_scaler_target, impute=True, n_quantiles=10, output_distribution='normal', quantile_range=(25, 75), n_bins=10, encode='ordinal', strategy='uniform', keep_n_decimals=5)`

**Parameters**

- **impute** (bool) –
- **n\_quantiles** (int) –
- **output\_distribution** (str) –
- **n\_bins** (int) –
- **encode** (str) –
- **strategy** (str) –
- **keep\_n\_decimals** (int) –

`graphistry.feature_utils.transform(df, ydf, res, kind, src, dst)`

**Parameters**

- **df** (DataFrame) –
- **ydf** (DataFrame) –
- **res** (List) –
- **kind** (str) –

**Return type** Tuple[DataFrame, DataFrame]

`graphistry.feature_utils.transform_dirty(df, data_encoder, name="")`

**Parameters**

- **df** (DataFrame) –
- **data\_encoder** (Any) –
- **name** (str) –

**Return type** DataFrame

`graphistry.feature_utils.transform_text(df, text_model, text_cols)`

**Parameters**

- **df** (DataFrame) –
- **text\_model** (Any) –
- **text\_cols** (Union[List, str]) –

**Return type** DataFrame



`graphistry.feature_utils.where_is_currency_column(df, col)`

**Parameters**

- **df** (DataFrame) –
- **col** (str) –



## UMAP

```
class graphistry.umap_utils.UMAPMixin(*args, **kwargs)
```

Bases: object

UMAP Mixin for automagic UMAPing

```
filter_weighted_edges (scale=1.0, index_to_nodes_dict=None, inplace=False, kind='nodes')
```

Filter edges based on `_weighted_edges_df` (ex: from `.umap()`)

### Parameters

- **scale** (float) –
- **index\_to\_nodes\_dict** (Optional[Dict]) –
- **inplace** (bool) –
- **kind** (str) –

```
transform_umap (df, y=None, kind='nodes', min_dist='auto', n_neighbors=7, merge_policy=False,  
                sample=None, return_graph=True, fit_umap_embedding=True, verbose=False)
```

Transforms data into UMAP embedding

### Args:

**df** Dataframe to transform

**y** Target column

**kind** One of *nodes* or *edges*

**min\_dist** Epsilon for including neighbors in `infer_graph`

**n\_neighbors** Number of neighbors to use for contextualization

**merge\_policy** if True, use previous graph, adding new batch to existing graph's neighbors  
useful to contextualize new data against existing graph. If False, *sample* is irrelevant.

*sample*: Sample number of existing graph's neighbors to use for contextualization – helps make denser graphs  
*return\_graph*: Whether to return a graph or just the embeddings  
*fit\_umap\_embedding*: Whether to infer graph from the UMAP embedding on the new data, default True  
*verbose*: Whether to print information about the graph inference

### Parameters

- **df** (DataFrame) –
- **y** (Optional[DataFrame]) –
- **kind** (str) –
- **min\_dist** (Union[str, float, int]) –

- **n\_neighbors** (int) –
- **merge\_policy** (bool) –
- **sample** (Optional[int]) –
- **return\_graph** (bool) –
- **fit\_umap\_embedding** (bool) –
- **verbose** (bool) –

**Return type** Union[Tuple[DataFrame, DataFrame, DataFrame], Plottable]

**umap** (*X=None, y=None, kind='nodes', scale=1.0, n\_neighbors=12, min\_dist=0.1, spread=0.5, local\_connectivity=1, repulsion\_strength=1, negative\_sample\_rate=5, n\_components=2, metric='euclidean', suffix='', play=0, encode\_position=True, encode\_weight=True, dbscan=False, engine='auto', feature\_engine='auto', inplace=False, memoize=True, verbose=False, \*\*feature\_ize\_kwargs*)

UMAP the featurized nodes or edges data, or pass in your own X, y (optional) dataframes of values

Example

```
>>> import graphistry
>>> g = graphistry.nodes(pd.DataFrame({'node': [0,1,2], 'data': [1,2,3], 'meta': ['a', 'b', 'c']}))
>>> g2 = g.umap(n_components=3, spread=1.0, min_dist=0.1, n_neighbors=12,
↳negative_sample_rate=5, local_connectivity=1, repulsion_strength=1.0,
↳metric='euclidean', suffix='', play=0, encode_position=True, encode_
↳weight=True, dbscan=False, engine='auto', feature_engine='auto',
↳inplace=False, memoize=True, verbose=False)
>>> g2.plot()
```

Parameters

**X** either a dataframe ndarray of features, or column names to featurize

**y** either an dataframe ndarray of targets, or column names to featurize targets

**kind** *nodes* or *edges* or *None*. If *None*, expects explicit X, y (optional) matrices, and will Not associate them to nodes or edges. If X, y (optional) is given, with kind = [nodes, edges], it will associate new matrices to nodes or edges attributes.

**scale** multiplicative scale for pruning weighted edge DataFrame gotten from UMAP, between [0, ..) with high end meaning keep all edges

**n\_neighbors** UMAP number of nearest neighbors to include for UMAP connectivity, lower makes more compact layouts. Minimum 2

**min\_dist** UMAP float between 0 and 1, lower makes more compact layouts.

**spread** UMAP spread of values for relaxation

**local\_connectivity** UMAP connectivity parameter

**repulsion\_strength** UMAP repulsion strength

**negative\_sample\_rate** UMAP negative sampling rate

**n\_components** number of components in the UMAP projection, default 2

**metric** UMAP metric, default 'euclidean'. see (UMAP-LEARN)[<https://umap-learn.readthedocs.io/en/latest/parameters.html>] documentation for more.

**suffix** optional suffix to add to x, y attributes of umap.

**play** Graphistry play parameter, default 0, how much to evolve the network during clustering. 0 preserves the original UMAP layout.

**encode\_weight** if True, will set new edges\_df from implicit UMAP, default True.

**encode\_position** whether to set default plotting bindings – positions x,y from umap for .plot(), default True

**dbscan** whether to run DBSCAN on the UMAP embedding, default False.

**engine** selects which engine to use to calculate UMAP: default “auto” will use cuML if available, otherwise UMAP-LEARN.

**feature\_engine** How to encode data (“none”, “auto”, “pandas”, “dirty\_cat”, “torch”)

**inplace** bool = False, whether to modify the current object, default False. when False, returns a new object, useful for chaining in a functional paradigm.

**memoize** whether to memoize the results of this method, default True.

**verbose** whether to print out extra information, default False.

**Returns** self, with attributes set with new data

#### Parameters

- **x** (Union[List[str], str, DataFrame, None]) –
- **y** (Union[List[str], str, DataFrame, None]) –
- **kind** (str) –
- **scale** (float) –
- **n\_neighbors** (int) –
- **min\_dist** (float) –
- **spread** (float) –
- **local\_connectivity** (int) –
- **repulsion\_strength** (float) –
- **negative\_sample\_rate** (int) –
- **n\_components** (int) –
- **metric** (str) –
- **suffix** (str) –
- **play** (Optional[int]) –
- **encode\_position** (bool) –
- **encode\_weight** (bool) –
- **dbscan** (bool) –
- **engine** (Literal[‘cuml’, ‘umap\_learn’, ‘auto’]) –
- **feature\_engine** (str) –
- **inplace** (bool) –
- **memoize** (bool) –
- **verbose** (bool) –

`umap_fit` (*X*, *y=None*, *verbose=False*)

**Parameters**

- **X** (DataFrame) –
- **y** (Optional[DataFrame]) –

`umap_lazy_init` (*res*, *n\_neighbors=12*, *min\_dist=0.1*, *spread=0.5*, *local\_connectivity=1*, *repulsion\_strength=1*, *negative\_sample\_rate=5*, *n\_components=2*, *metric='euclidean'*, *engine='auto'*, *suffix=""*, *verbose=False*)

**Parameters**

- **n\_neighbors** (int) –
- **min\_dist** (float) –
- **spread** (float) –
- **local\_connectivity** (int) –
- **repulsion\_strength** (float) –
- **negative\_sample\_rate** (int) –
- **n\_components** (int) –
- **metric** (str) –
- **engine** (Literal['cuml', 'umap\_learn', 'auto']) –
- **suffix** (str) –
- **verbose** (bool) –

`graphistry.umap_utils.assert_imported()`

`graphistry.umap_utils.assert_imported_cuml()`

`graphistry.umap_utils.is_legacy_cuml()`

`graphistry.umap_utils.lazy_cudf_import_has_dependency()`

`graphistry.umap_utils.lazy_cuml_import_has_dependency()`

`graphistry.umap_utils.lazy_umap_import_has_dependency()`

`graphistry.umap_utils.make_safe_gpu_dataframes` (*X*, *y*, *engine*)

`graphistry.umap_utils.resolve_umap_engine` (*engine*)

**Parameters** *engine* (Literal['cuml', 'umap\_learn', 'auto']) –

**Return type** Literal['cuml', 'umap\_learn']

`graphistry.umap_utils.reuse_umap` (*g*, *memoize*, *metadata*)

**Parameters**

- **g** (Plottable) –
- **memoize** (bool) –
- **metadata** (Any) –

`graphistry.umap_utils.umap_graph_to_weighted_edges` (*umap\_graph*, *engine*,  
*is\_legacy*, *cfg=<module*  
*'graphistry.constants'* *from*  
*/home/docs/checkouts/readthedocs.org/user\_builds/pygrap*

## SEMANTIC SEARCH

```
class graphistry.text_utils.SearchToGraphMixin(*args, **kwargs)
    Bases: object

    assert_features_line_up_with_nodes()

    assert_fitted()

    build_index(angular=False, n_trees=None)

    classmethod load_search_instance(savepath)

    save_search_instance(savepath)

    search(query, cols=None, thresh=5000, fuzzy=True, top_n=10)
        Natural language query over nodes that returns a dataframe of results sorted by relevance column “distance”.
```

If node data is not yet feature-encoded (and explicit edges are given), run automatic feature engineering:

```
g2 = g.featurize(kind='nodes', X=['text_col_1', ..],
min_words=0 # forces all named columns are textually encoded
)
```

If edges do not yet exist, generate them via

```
g2 = g.umap(kind='nodes', X=['text_col_1', ..],
min_words=0 # forces all named columns are textually encoded
)
```

If an index is not yet built, it is generated `g2.build_index()` on the fly at search time. Otherwise, can set `g2.build_index()` to build it ahead of time.

### Args:

**query (str)** natural language query.

**cols (list or str, optional)** if `fuzzy=False`, select which column to query. Defaults to `None` since `fuzzy=True` by default.

**thresh (float, optional)** distance threshold from query vector to returned results. Defaults to 5000, set large just in case, but could be as low as 10.

**fuzzy (bool, optional)** if `True`, uses embedding + annoy index for recall, otherwise does string matching over given `cols`. Defaults to `True`.

**top\_n (int, optional)** how many results to return. Defaults to 100.

**Returns:** `pd.DataFrame`, **vector\_encoding\_of\_query:** rank ordered dataframe of results matching query

vector encoding of query via given transformer/ngrams model if `fuzzy=True` else `None`

### Parameters

- **query** (`str`) –
- **thresh** (`float`) –
- **fuzzy** (`bool`) –
- **top\_n** (`int`) –

**search\_graph** (*query, scale=0.5, top\_n=100, thresh=5000, broader=False, inplace=False*)

**Input a natural language query and return a graph of results.** See `help(g.search)` for more information

### Args:

**query (str)** query input eg “coding best practices”

**scale (float, optional)** edge weigh threshold, Defaults to 0.5.

**top\_n (int, optional)** how many results to return. Defaults to 100.

**thresh (float, optional)** distance threshold from query vector to returned results. Defaults to 5000, set large just in case, but could be as low as 10.

**broader (bool, optional)** if `True`, will retrieve entities connected via an edge that were not necessarily bubbled up in the `results_dataframe`. Defaults to `False`.

**inplace (bool, optional)** whether to return new instance (default) or mutate self. Defaults to `False`.

**Returns:** graphistry Instance: `g`

### Parameters

- **query** (`str`) –
- **scale** (`float`) –
- **top\_n** (`int`) –
- **thresh** (`float`) –
- **broader** (`bool`) –
- **inplace** (`bool`) –



## DBSCAN

```
class graphistry.compute.cluster.ClusterMixin(*args, **kwargs)
```

Bases: object

```
dbscan(min_dist=0.2, min_samples=1, cols=None, kind='nodes', fit_umap_embedding=True, target=False, verbose=False, engine_dbscan='sklearn', *args, **kwargs)
```

**DBSCAN clustering on cpu or gpu inferred automatically. Adds a `_dbscan` column to nodes or edges.**

NOTE: `g.transform_dbscan(..)` currently unsupported on GPU.

Examples:

```
g = graphistry.edges(edf, 'src', 'dst').nodes(ndf, 'node')

# cluster by UMAP embeddings
kind = 'nodes' | 'edges'
g2 = g.umap(kind=kind).dbscan(kind=kind)
print(g2._nodes['_dbscan']) | print(g2._edges['_dbscan'])

# dbscan in umap or featurize API
g2 = g.umap(dbscan=True, min_dist=1.2, min_samples=2, **kwargs)
# or, here dbscan is inferred from features, not umap embeddings
g2 = g.featurize(dbscan=True, min_dist=1.2, min_samples=2, **kwargs)

# and via chaining,
g2 = g.umap().dbscan(min_dist=1.2, min_samples=2, **kwargs)

# cluster by feature embeddings
g2 = g.featurize().dbscan(**kwargs)

# cluster by a given set of feature column attributes, or with target=True
g2 = g.featurize().dbscan(cols=['ip_172', 'location', 'alert'], target=False,
↳ **kwargs)

# equivalent to above (ie, cols != None and umap=True will still use features,
↳ dataframe, rather than UMAP embeddings)
g2 = g.umap().dbscan(cols=['ip_172', 'location', 'alert'], umap=True | False,
↳ **kwargs)

g2.plot() # color by `_dbscan` column
```

**Useful:** Enriching the graph with cluster labels from UMAP is useful for visualizing clusters in the graph by color, size, etc, as well as assessing metrics per cluster, e.g. <https://github.com/graphistry/pygraphistry/blob/master/demos/ai/cyber/cyber-redteam-umap-demo.ipynb>

**Args:**

**min\_dist float** The maximum distance between two samples for them to be considered as in the same neighborhood.

**kind str** 'nodes' or 'edges'

**cols** list of columns to use for clustering given *g.featurize* has been run, nice way to slice features or targets by fragments of interest, e.g. ['ip\_172', 'location', 'ssh', 'warnings']

**fit\_umap\_embedding bool** whether to use UMAP embeddings or features dataframe to cluster DBSCAN

**min\_samples** The number of samples in a neighborhood for a point to be considered as a core point. This includes the point itself.

**target** whether to use the target column as the clustering feature

### Parameters

- **min\_dist** (float)–
- **min\_samples** (int)–
- **cols** (Union[List, str, None])–
- **kind** (str)–
- **fit\_umap\_embedding** (bool)–
- **target** (bool)–
- **verbose** (bool)–
- **engine\_dbscan** (str)–

**transform\_dbscan** (*df, y=None, min\_dist='auto', infer\_umap\_embedding=False, sample=None, n\_neighbors=None, kind='nodes', return\_graph=True, verbose=False*)

Transforms a minibatch dataframe to one with a new column '\_dbscan' containing the DBSCAN cluster labels on the minibatch and generates a graph with the minibatch and the original graph, with edges between the minibatch and the original graph inferred from the umap embedding or features dataframe. Graph nodes | edges will be colored by '\_dbscan' column.

Examples:

```
fit:
    g = graphistry.edges(edf, 'src', 'dst').nodes(ndf, 'node')
    g2 = g.featurize().dbscan()

predict:
::

    emb, X, _, ndf = g2.transform_dbscan(ndf, return_graph=False)
    # or
    g3 = g2.transform_dbscan(ndf, return_graph=True)
    g3.plot()
```

likewise for umap:

```
fit:
    g = graphistry.edges(edf, 'src', 'dst').nodes(ndf, 'node')
    g2 = g.umap(X=., y=.).dbscan()

predict:
```

(continues on next page)

(continued from previous page)

```

::
    emb, X, y, ndf = g2.transform_dbscan(ndf, ndf, return_graph=False)
    # or
    g3 = g2.transform_dbscan(ndf, ndf, return_graph=True)
    g3.plot()

```

**Args:****df** dataframe to transform**y** optional labels dataframe**min\_dist** The maximum distance between two samples for them to be considered as in the same neighborhood. smaller values will result in less edges between the minibatch and the original graph. Default 'auto', infers min\_dist from the mean distance and std of new points to the original graph**fit\_umap\_embedding** whether to use UMAP embeddings or features dataframe when inferring edges between the minibatch and the original graph. Default False, uses the features dataframe**sample** number of samples to use when inferring edges between the minibatch and the original graph, if None, will only use closest point to the minibatch. If greater than 0, will sample the closest *sample* points in existing graph to pull in more edges. Default None**kind** 'nodes' or 'edges'**return\_graph** whether to return a graph or the (emb, X, y, minibatch df enriched with DBSCAN labels), default True inferred graph supports kind='nodes' only.**verbose** whether to print out progress, default False**Parameters**

- **df** (DataFrame) –
- **y** (Optional[DataFrame]) –
- **min\_dist** (Union[float, str]) –
- **infer\_umap\_embedding** (bool) –
- **sample** (Optional[int]) –
- **n\_neighbors** (Optional[int]) –
- **kind** (str) –
- **return\_graph** (bool) –
- **verbose** (bool) –

```

graphistry.compute.cluster.dbscan_fit(g, dbscan, kind='nodes', cols=None,
                                       use_umap_embedding=True, target=False, verbose=False)

```

**Fits clustering on UMAP embeddings if umap is True, otherwise on the features dataframe or target dataframe if target is True.**

**Args:****g** graphistry graph

**kind** 'nodes' or 'edges'

**cols** list of columns to use for clustering given *g.featurize* has been run

**use\_umap\_embedding** whether to use UMAP embeddings or features dataframe for clustering (default: True)

**Parameters**

- **g** (Any) –
- **dbscan** (Any) –
- **kind** (str) –
- **cols** (Union[List, str, None]) –
- **use\_umap\_embedding** (bool) –
- **target** (bool) –
- **verbose** (bool) –

`graphistry.compute.cluster.dbscan_predict(X, model)`

DBSCAN has no predict per se, so we reverse engineer one here from <https://stackoverflow.com/questions/27822752/scikit-learn-predicting-new-points-with-dbscan>

**Parameters**

- **X** (DataFrame) –
- **model** (Any) –

`graphistry.compute.cluster.get_model_matrix(g, kind, cols, umap, target)`

Allows for a single function to get the model matrix for both nodes and edges as well as targets, embeddings, and features

**Args:**

**g** graphistry graph

**kind** 'nodes' or 'edges'

**cols** list of columns to use for clustering given *g.featurize* has been run

**umap** whether to use UMAP embeddings or features dataframe

**target** whether to use the target dataframe or features dataframe

**Returns:** pd.DataFrame: dataframe of model matrix given the inputs

**Parameters**

- **kind** (str) –
- **cols** (Union[List, str, None]) –

`graphistry.compute.cluster.lazy_cudf_import_has_dependency()`

`graphistry.compute.cluster.lazy_dbscan_import_has_dependency()`

`graphistry.compute.cluster.make_safe_gpu_dataframes(X, y, engine)`  
helper method to coerce a dataframe to the correct type (pd vs cudf)

`graphistry.compute.cluster.resolve_cpu_gpu_engine(engine)`

**Parameters** `engine` (Literal['cuml', 'umap\_learn', 'auto']) –

**Return type** Literal['cuml', 'umap\_learn']



## ARROW UPLOADER MODULE

```

class graphistry.arrow_uploader.ArrowUploader (server_base_path='http://nginx',
                                              view_base_path='http://localhost',
                                              name=None,          description=None,
                                              edges=None,         nodes=None,
                                              node_encodings=None,
                                              edge_encodings=None, token=None,
                                              dataset_id=None,     metadata=None,
                                              certificate_validation=True,
                                              org_name=None)

```

Bases: object

**Parameters** `org_name` (Optional[str]) –

**arrow\_to\_buffer** (*table*)

**Parameters** `table` (Table) –

**cascade\_privacy\_settings** (*mode=None, notify=None, invited\_users=None,*  
*mode\_action=None, message=None*)

**Cascade:**

- local (passed in)
- global
- hard-coded

**Parameters**

- **mode** (Optional[Literal['private', 'organization', 'public']]) –
- **notify** (Optional[bool]) –
- **invited\_users** (Optional[List[str]]) –
- **mode\_action** (Optional[str]) –
- **message** (Optional[str]) –

**property** `certificate_validation`

**create\_dataset** (*json*)

**property** `dataset_id`

**Return type** `str`

**property** `description`

**Return type** `str`

**property edge\_encodings**

**property edges**

**Return type** `Table`

**g\_to\_edge\_bindings** (*g*)

**g\_to\_edge\_encodings** (*g*)

**g\_to\_node\_bindings** (*g*)

**g\_to\_node\_encodings** (*g*)

**login** (*username, password, org\_name=None*)

**maybe\_bindings** (*g, bindings, base={}*)

**maybe\_post\_share\_link** (*g*)

Skip if never called `.privacy()` Return True/False based on whether called

**Return type** `bool`

**property metadata**

**property name**

**Return type** `str`

**property node\_encodings**

**property nodes**

**Return type** `Table`

**property org\_name**

**Return type** `Optional[str]`

**pkey\_login** (*personal\_key\_id, personal\_key\_secret, org\_name=None*)

**post** (*as\_files=True, memoize=True*)

Note: likely want to pair with `self.maybe_post_share_link(g)`

**Parameters**

- **as\_files** (`bool`) –
- **memoize** (`bool`) –

**post\_arrow** (*arr, graph\_type, opts=""*)

**Parameters**

- **arr** (`Table`) –
- **graph\_type** (`str`) –
- **opts** (`str`) –

**post\_arrow\_generic** (*sub\_path, tok, arr, opts=""*)

**Parameters**

- **sub\_path** (`str`) –
- **tok** (`str`) –
- **arr** (`Table`) –



**Return type** Response

**post\_edges\_arrow** (*arr=None, opts=""*)

**post\_edges\_file** (*file\_path, file\_type='csv'*)

**post\_file** (*file\_path, graph\_type='edges', file\_type='csv'*)

**post\_g** (*g, name=None, description=None*)

Warning: main post() does not call this

**post\_nodes\_arrow** (*arr=None, opts=""*)

**post\_nodes\_file** (*file\_path, file\_type='csv'*)

**post\_share\_link** (*obj\_pk, obj\_type='dataset', privacy=None*)

Set sharing settings. Any settings not passed here will cascade from PyGraphistry or defaults

**Parameters**

- **obj\_pk** (str) –
- **obj\_type** (str) –
- **privacy** (Optional[Privacy]) –

**refresh** (*token=None*)

**property server\_base\_path**

**Return type** str

**sso\_get\_token** (*state*)

Koa, 04 May 2022 Use state to get token

**sso\_login** (*org\_name=None, idp\_name=None*)

Koa, 04 May 2022 Get SSO login auth\_url or token

**property token**

**Return type** str

**verify** (*token=None*)

**Return type** bool

**property view\_base\_path**

**Return type** str



## ARROW FILE UPLOADER MODULE

**class** graphistry.ArrowFileUploader.**ArrowFileUploader** (*uploader*)

Bases: object

Implement file API with focus on Arrow support

Memoization in this class is based on reference equality, while plotter is based on hash. That means the plotter resolves different-identity value matches, so by the time ArrowFileUploader compares, identities are unified for faster reference-based checks.

**Example: Upload files with per-session memoization** `uploader : ArrowUploader arr : pa.Table afu = ArrowFileUploader(uploader)`

```
file1_id = afu.create_and_post_file(arr)[0] file2_id = afu.create_and_post_file(arr)[0]
```

```
assert file1_id == file2_id # memoizes by default (memory-safe: weak refs)
```

**Example: Explicitly create a file and upload data for it** `uploader : ArrowUploader arr : pa.Table afu = ArrowFileUploader(uploader)`

```
file1_id = afu.create_file() afu.post_arrow(arr, file_id)
```

```
file2_id = afu.create_file() afu.post_arrow(arr, file_id)
```

```
assert file1_id != file2_id
```

**create\_and\_post\_file** (*arr*, *file\_id=None*, *file\_opts={}*, *upload\_url\_opts='erase=true'*, *memoize=True*)

Create file and upload data for it.

Default `upload_url_opts='erase=true'` throws exceptions on parse errors and deletes upload.

Default `memoize=True` skips uploading 'arr' when previously uploaded in current session

See File REST API for `file_opts` (file create) and `upload_url_opts` (file upload)

### Parameters

- **arr** (Table) –
- **file\_id** (Optional[str]) –
- **file\_opts** (dict) –
- **upload\_url\_opts** (str) –
- **memoize** (bool) –

**Return type** Tuple[str, dict]

**create\_file** (*file\_opts={}*)

Creates File and returns `file_id` str.

**Defaults:**

- `file_type`: 'arrow'

See File REST API for `file_opts`

**Parameters** `file_opts` (dict) -

**Return type** `str`

**post\_arrow** (*arr*, *file\_id*, *url\_opts*='erase=true')

Upload new data to existing file id

Default `url_opts`='erase=true' throws exceptions on parse errors and deletes upload.

See File REST API for `url_opts` (file upload)

**Parameters**

- `arr` (Table) -
- `file_id` (str) -
- `url_opts` (str) -

**Return type** `dict`

**uploader:** `Any = None`

`graphistry.ArrowFileUploader.DF_TO_FILE_ID_CACHE: weakref.WeakKeyDictionary = <WeakKeyDict...`

**NOTE:** Will switch to `pa.Table` -> ... when RAPIDS upgrades from `pyarrow`, which adds `weakref` support

**class** `graphistry.ArrowFileUploader.MemoizedFileUpload` (*file\_id*, *output*)

Bases: `object`

**Parameters**

- `file_id` (str) -
- `output` (dict) -

**file\_id:** `str`

**output:** `dict`

**class** `graphistry.ArrowFileUploader.WrappedTable` (*arr*)

Bases: `object`

**Parameters** `arr` (Table) -

**arr:** `pyarrow.lib.Table`

`graphistry.ArrowFileUploader.cache_arr` (*arr*)

Hold reference to most recent memoization entries Hack until RAPIDS supports Arrow 2.0, when `pa.Table` becomes weakly referenceable

## VERSIONEER

Git implementation of `_version.py`.

**exception** `graphistry._version.NotThisMethod`

Bases: `Exception`

Exception raised if a method is not valid for the current scenario.

**class** `graphistry._version.VersioneerConfig`

Bases: `object`

Container for Versioneer configuration parameters.

`graphistry._version.get_config()`

Create, populate and return the `VersioneerConfig()` object.

`graphistry._version.get_keywords()`

Get the keywords needed to look up the version information.

`graphistry._version.get_versions()`

Get version information or return default if unable to do so.

`graphistry._version.git_get_keywords(versionfile_abs)`

Extract version information from the given file.

`graphistry._version.git_pieces_from_vcs(tag_prefix, root, verbose, run_command=<function run_command>)`

Get version from 'git describe' in the root of the source tree.

This only gets called if the git-archive 'subst' keywords were *not* expanded, and `_version.py` hasn't already been rewritten with a short version string, meaning we're inside a checked out source tree.

`graphistry._version.git_versions_from_keywords(keywords, tag_prefix, verbose)`

Get version information from git keywords.

`graphistry._version.plus_or_dot(pieces)`

Return a + if we don't already have one, else return a .

`graphistry._version.register_vcs_handler(vcs, method)`

Create decorator to mark a method as the handler of a VCS.

`graphistry._version.render(pieces, style)`

Render the given version pieces into the requested style.

`graphistry._version.render_git_describe(pieces)`

TAG[-DISTANCE-gHEX][-dirty].

Like 'git describe -tags -dirty -always'.

Exceptions: 1: no tags. HEX[-dirty] (note: no 'g' prefix)

`graphistry._version.render_git_describe_long` (*pieces*)  
TAG-DISTANCE-gHEX[-dirty].

Like `'git describe -tags -dirty -always -long'`. The distance/hash is unconditional.

Exceptions: 1: no tags. HEX[-dirty] (note: no 'g' prefix)

`graphistry._version.render_pep440` (*pieces*)  
Build up version string, with post-release "local version identifier".

Our goal: TAG[+DISTANCE.gHEX[.dirty]] . Note that if you get a tagged build and then dirty it, you'll get TAG+0.gHEX.dirty

Exceptions: 1: no tags. git\_describe was just HEX. 0+untagged.DISTANCE.gHEX[.dirty]

`graphistry._version.render_pep440_old` (*pieces*)  
TAG[.postDISTANCE[.dev0]] .

The ".dev0" means dirty.

Exceptions: 1: no tags. 0.postDISTANCE[.dev0]

`graphistry._version.render_pep440_post` (*pieces*)  
TAG[.postDISTANCE[.dev0]+gHEX] .

The ".dev0" means dirty. Note that .dev0 sorts backwards (a dirty tree will appear "older" than the corresponding clean one), but you shouldn't be releasing software with -dirty anyways.

Exceptions: 1: no tags. 0.postDISTANCE[.dev0]

`graphistry._version.render_pep440_pre` (*pieces*)  
TAG[.post0.devDISTANCE] – No -dirty.

Exceptions: 1: no tags. 0.post0.devDISTANCE

`graphistry._version.run_command` (*commands*, *args*, *cwd=None*, *verbose=False*,  
*hide\_stderr=False*, *env=None*)

Call the given command(s).

`graphistry._version.versions_from_parentdir` (*parentdir\_prefix*, *root*, *verbose*)

Try to determine the version from the parent directory name.

Source tarballs conventionally unpack into a directory that includes both the project name and a version string. We will also support searching up two directory levels for an appropriately named parent directory

## 12.1 graphistry.plugins\_types package

### 12.1.1 graphistry.layout.utils package

#### graphistry.layout.graph package

##### Submodules

#### graphistry.layout.graph.edge module

**class** graphistry.layout.graph.edge.**Edge** (*x, y, w=1, data=None, connect=False*)

Bases: *graphistry.layout.graph.edgeBase.EdgeBase*

A graph edge.

##### Attributes

- **data** (object): an optional payload
- **w** (int): an optional weight associated with the edge (default 1) used by Dijkstra to find min-flow paths.
- **feedback** (bool): whether the Tarjan algorithm has inverted this edge to de-cycle the graph.

##### **attach** ()

Attach this edge to the edge collections of the vertices.

**data:** object

**degree:** int

Is 0 if a loop, otherwise 1.

##### **detach** ()

Removes this edge from the edge collections of the vertices.

**feedback:** bool

**w:** int

### graphistry.layout.graph.edgeBase module

**class** graphistry.layout.graph.edgeBase.**EdgeBase** (*x, y*)

Bases: object

Base class for edges.

#### Attributes

- **degree** (int): degree of the edge (number of unique vertices).
- **v** (list[Vertex]): list of vertices associated with this edge.

**degree:** int

Is 0 if a loop, otherwise 1.

### graphistry.layout.graph.graph module

**class** graphistry.layout.graph.graph.**Graph** (*vertices=None, edges=None, directed=True*)

Bases: object

**N** (*v, f\_io=0*)

**add\_edge** (*e*)

add edge e and its vertices into the Graph possibly merging the associated graph\_core components

**add\_edges** (*edges*)

**Parameters** *edges* (List) –

**add\_vertex** (*v*)

add vertex v into the Graph as a new component

**component\_class**

alias of *graphistry.layout.graph.graphBase.GraphBase*

**connected** ()

returns the list of components

**deg\_avg** ()

the average degree of vertices

**deg\_max** ()

the maximum degree of vertices

**deg\_min** ()

the minimum degree of vertices

**edges** ()

**eps** ()

the graph epsilon value (norm/order), average number of edges per vertex.

**get\_vertex\_from\_data** (*data*)

**get\_vertices\_count** ()

**norm** ()

the norm of the graph (number of edges)

**order** ()

the order of the graph (number of vertices)

**path** (*x, y, f\_io=0, hook=None*)



**remove\_edge** (*e*)  
 remove edge *e* possibly spawning two new cores if the `graph_core` that contained *e* gets disconnected.

**remove\_vertex** (*x*)  
 remove vertex *v* and all its edges.

**vertices** ()  
 see `graph_core`

## graphistry.layout.graph.graphBase module

**class** `graphistry.layout.graph.graphBase.GraphBase` (*vertices=None, edges=None, directed=True*)

Bases: `object`

A connected graph of Vertex/Edge objects. A GraphBase is a *component* of a Graph that contains a connected set of Vertex and Edges.

**Attributes:** `verticesPoset` (`Poset[Vertex]`): the partially ordered set of vertices of the graph. `edgesPoset` (`Poset[Edge]`): the partially ordered set of edges of the graph. `loops` (`set[Edge]`): the set of *loop* edges (of degree 0). `directed` (`bool`): indicates if the graph is considered *oriented* or not.

**N** (*v, f\_io=0*)

**add\_edge** (*e*)  
 add edge *e*. At least one of its vertex must belong to the graph, the other being added automatically.

**add\_single\_vertex** (*v*)  
 allow a GraphBase to hold a single vertex.

**complement** (*G*)

**constant\_function** (*value*)

**contract** (*e*)

**deg\_avg** ()  
 the average degree of vertices

**deg\_max** ()  
 the maximum degree of vertices

**deg\_min** ()  
 the minimum degree of vertices

**dft** (*start\_vertex=None*)

**dijkstra** (*x, f\_io=0, hook=None*)  
 shortest weighted-edges paths between *x* and all other vertices by dijkstra's algorithm with heap used as priority queue.

**edges** (*cond=None*)  
 generates an iterator over edges, with optional filter

**eps** ()  
 the graph epsilon value (norm/order), average number of edges per vertex.

**get\_scs\_with\_feedback** (*roots=None*)

Minimum FAS algorithm (feedback arc set) creating a DAG. Returns the set of strongly connected components ("scs") by using Tarjan algorithm. These are maximal sets of vertices such that there is a path from each vertex to every other vertex. The algorithm performs a DFS from the provided list of root vertices. A cycle is of course a strongly connected component, but a strongly connected

component can include several cycles. The Feedback Acyclic Set of edge to be removed/reversed is provided by marking the edges with a “feedback” flag. Complexity is  $O(V+E)$ .

**Parameters** `roots` –

**Returns**

**leaves** ()

returns the list of *leaves* (vertices with no outward edges).

**matrix** (*cond=None*)

This associativity matrix is like the adjacency matrix but antisymmetric. Returns the associativity matrix of the graph component

**Parameters** `cond` – same as the condition function in `vertices()`.

**Returns** array

**norm** ()

The size of the edge poset (number of edges).

**order** ()

the order of the graph (number of vertices)

**partition** ()

**path** (*x, y, f\_io=0, hook=None*)

shortest path between vertices *x* and *y* by breadth-first descent, constrained by *f\_io* direction if provided. The path is returned as a list of Vertex objects. If a *hook* function is provided, it is called at every vertex added to the path, passing the vertex object as argument.

**remove\_edge** (*e*)

remove Edge *e*, asserting that the resulting graph is still connex.

**remove\_vertex** (*x*)

remove Vertex *x* and all associated edges.

**roots** ()

returns the list of *roots* (vertices with no inward edges).

**spans** (*vertices*)

**union\_update** (*G*)

**vertices** (*cond=None*)

generates an iterator over vertices, with optional filter

### graphistry.layout.graph.vertex module

**class** `graphistry.layout.graph.vertex.Vertex` (*data=None*)

Bases: `graphistry.layout.graph.vertexBase.VertexBase`

Vertex class enhancing a VertexBase with graph-related features.

**Attributes** `component` (GraphBase): the component of connected vertices that contains this vertex. By default, a vertex belongs no component but when it is added in a graph, `c` points to the connected component in this graph. `data` (object): an object associated with the vertex.

**property** `index`

**graphistry.layout.graph.vertexBase module****class** graphistry.layout.graph.vertexBase.**VertexBase**

Bases: object

Base class for vertices.

**Attributes** e (list[Edge]): list of edges associated with this vertex.**degree** ()

degree(): degree of the vertex (number of edges).

**detach** ()

removes this vertex from all its edges and returns this list of edges.

**e\_dir** (dir)

either e\_in, e\_out or all edges depending on provided direction parameter (&gt;0 means outward).

**e\_from** (x)

returns the Edge from vertex v directed toward this vertex.

**e\_in** ()

e\_in(): list of edges directed toward this vertex.

**e\_out** ()

e\_out(): list of edges directed outward this vertex.

**e\_to** (y)

returns the Edge from this vertex directed toward vertex v.

**e\_with** (v)

return the Edge with both this vertex and vertex v

**neighbors** (direction=0)

Returns the neighbors of this vertex. List of neighbor vertices in all directions (default) or in filtered f\_io direction (&gt;0 means outward).

**Parameters direction** –

- 0: parent and children
- -1: parents
- +1: children

**Returns** list of vertices**Module contents**

graphistry.layout.gib

## Submodules

### graphistry.layout.utils.dummyVertex module

**class** graphistry.layout.utils.dummyVertex.**DummyVertex** (*r=None*)

Bases: *graphistry.layout.utils.layoutVertex.LayoutVertex*

A DummyVertex is used for edges that span over several layers, it's inserted in every inner layer.

#### Attributes

- view (viewclass): since a DummyVertex is acting as a Vertex, it must have a view.
- ctrl (list[\_sugiyama\_attr]): the list of associated dummy vertices.

**inner** (*direction*)

True if a neighbor in the given direction is *dummy*.

**neighbors** (*direction*)

Reflect the Vertex method and returns the list of adjacent vertices (possibly dummy) in the given direction.  
:type direction: int :param direction: +1 for the next layer (children) and -1 (parents) for the previous

### graphistry.layout.utils.geometry module

graphistry.layout.utils.geometry.**angle\_between\_vectors** (*p1, p2*)

graphistry.layout.utils.geometry.**lines\_intersection** (*xy1, xy2, xy3, xy4*)

Returns the intersection of two lines.

graphistry.layout.utils.geometry.**new\_point\_at\_distance** (*pt, distance, angle*)

graphistry.layout.utils.geometry.**rectangle\_point\_intersection** (*rec, p*)

Returns the intersection point between the Rectangle (w,h) that characterize the rec object and the line that goes from the recs' object center to the 'p' point.

graphistry.layout.utils.geometry.**set\_round\_corner** (*e, pts*)

graphistry.layout.utils.geometry.**setcurve** (*e, pts, tgs=None*)

Returns the spline curve that path through the list of points P. The spline curve is a list of cubic bezier curves (nurbs) that have matching tangents at their extreme points. The method considered here is taken from "The NURBS book" (Les A. Piegl, Wayne Tiller, Springer, 1997) and implements a local interpolation rather than a global interpolation.

**Args:** e: pts: tgs:

Returns:

graphistry.layout.utils.geometry.**size\_median** (*recs*)

graphistry.layout.utils.geometry.**tangents** (*P, n*)

**graphistry.layout.utils.layer module**

**class** graphistry.layout.utils.layer.**Layer** (*iterable=()*,/)

Bases: list

Layer is where Sugiyama layout organises vertices in hierarchical lists. The placement of a vertex is done by the Sugiyama class, but it highly relies on the *ordering* of vertices in each layer to reduce crossings. This ordering depends on the neighbors found in the upper or lower layers.

**Attributes:** layout (SugiyamaLayout): a reference to the sugiyama layout instance that contains this layer upper (Layer): a reference to the *upper* layer (layer-1) lower (Layer): a reference to the *lower* layer (layer+1) crossings (int) : number of crossings detected in this layer

**Methods:** setup (layout): set initial attributes values from provided layout nextlayer(): returns *next* layer in the current layout's direction parameter. prevlayer(): returns *previous* layer in the current layout's direction parameter. order(): compute *optimal* ordering of vertices within the layer.

**crossings = None**

**layout = None**

**lower = None**

**neighbors (v)**

neighbors refer to upper/lower adjacent nodes. Note that v.neighbors() provides neighbors of v in the graph, while this method provides the Vertex and DummyVertex adjacent to v in the upper or lower layer (depending on layout.dirv state).

**nextlayer ()**

**order ()**

**prevlayer ()**

**setup (layout)**

**upper = None**

**graphistry.layout.utils.layoutVertex module**

**class** graphistry.layout.utils.layoutVertex.**LayoutVertex** (*layer=None, is\_dummy=0*)

Bases: object

The Sugiyama layout adds new attributes to vertices. These attributes are stored in an internal `_sugimyama_vertex_attr` object.

**Attributes:** layer (int): layer number dummy (0/1): whether the vertex is a dummy pos (int): the index of the vertex within the layer x (list(float)): the list of computed horizontal coordinates of the vertex bar (float): the current barycenter of the vertex

**Parameters layer** (Optional[int]) –

### graphistry.layout.utils.poset module

**class** graphistry.layout.utils.poset.**Poset** (*collection=[]*)

Bases: object

Poset class implements a set but allows to integrate over the elements in a deterministic way and to get specific objects in the set. Membership operator defaults to comparing `__hash__` of objects but Poset allows to check for `__cmp__`/`__eq__` membership by using `contains__cmp__(obj)`

**add** (*obj*)

**contains\_\_cmp\_\_** (*obj*)

**copy** ()

**deepcopy** ()

**difference** (*\*args*)

**get** (*obj*)

**index** (*obj*)

**intersection** (*\*args*)

**issubset** (*other*)

**issuperset** (*other*)

**remove** (*obj*)

**symmetric\_difference** (*\*args*)

**union** (*other*)

**update** (*other*)

### graphistry.layout.utils.rectangle module

**class** graphistry.layout.utils.rectangle.**Rectangle** (*w=1, h=1*)

Bases: object

Rectangular region.

### graphistry.layout.utils.routing module

**class** graphistry.layout.utils.routing.**EdgeViewer**

Bases: object

**setpath** (*pts*)

graphistry.layout.utils.routing.**route\_with\_lines** (*e, pts*)

Basic edge routing with lines. The layout pass has already provided to list of points through which the edge shall be drawn. We just compute the position where to adjust the tail and head.

graphistry.layout.utils.routing.**route\_with\_rounded\_corners** (*e, pts*)

graphistry.layout.utils.routing.**route\_with\_splines** (*e, pts*)

Enhanced edge routing where 'corners' of the above polyline route are rounded with a Bezier curve.

**Module contents**

**12.1.2 Submodules**

**12.1.3 graphistry.plugins\_types.cugraph\_types module**

**12.1.4 Module contents**





---

CHAPTER  
**THIRTEEN**

---

**ARTICLES**

- [Graphistry: Visual Graph AI Interactive demo](#)
- [PyGraphistry + Databricks](#)
- [PyGraphistry + UMAP](#)



## INDICES AND TABLES

- genindex
- modindex
- search



## A

add() (*graphistry.layout.utils.poset.Poset method*), 114  
 add\_edge() (*graphistry.layout.graph.graph.Graph method*), 108  
 add\_edge() (*graphistry.layout.graph.graphBase.GraphBase method*), 109  
 add\_edges() (*graphistry.layout.graph.graph.Graph method*), 108  
 add\_single\_vertex() (*graphistry.layout.graph.graphBase.GraphBase method*), 109  
 add\_vertex() (*graphistry.layout.graph.graph.Graph method*), 108  
 angle\_between\_vectors() (*in module graphistry.layout.utils.geometry*), 112  
 arr (*graphistry.ArrowFileUploader.WrappedTable attribute*), 104  
 arrow\_to\_buffer() (*graphistry.arrow\_uploader.ArrowUploader method*), 99  
 ArrowFileUploader (*class in graphistry.ArrowFileUploader*), 103  
 ArrowUploader (*class in graphistry.arrow\_uploader*), 99  
 assert\_features\_line\_up\_with\_nodes() (*graphistry.text\_utils.SearchToGraphMixin method*), 91  
 assert\_fitted() (*graphistry.text\_utils.SearchToGraphMixin method*), 91  
 assert\_imported() (*in module graphistry.feature\_utils*), 75  
 assert\_imported() (*in module graphistry.umap\_utils*), 90  
 assert\_imported\_cumulative() (*in module graphistry.umap\_utils*), 90  
 assert\_imported\_text() (*in module graphistry.feature\_utils*), 75  
 attach() (*graphistry.layout.graph.edge.Edge method*), 107

## B

build\_index() (*graphistry.text\_utils.SearchToGraphMixin*)

*method*), 91

## C

cache\_arr() (*in module graphistry.ArrowFileUploader*), 104  
 callThrough (*class in graphistry.feature\_utils*), 75  
 cascade\_privacy\_settings() (*graphistry.arrow\_uploader.ArrowUploader method*), 99  
 certificate\_validation() (*graphistry.arrow\_uploader.ArrowUploader property*), 99  
 check\_if\_textual\_column() (*in module graphistry.feature\_utils*), 76  
 ClusterMixin (*class in graphistry.compute.cluster*), 93  
 complement() (*graphistry.layout.graph.graphBase.GraphBase method*), 109  
 component\_class (*graphistry.layout.graph.graph.Graph attribute*), 108  
 compute\_cugraph() (*in module graphistry.plugins.cugraph*), 38  
 compute\_igraph() (*in module graphistry.plugins.igraph*), 35  
 concat\_text() (*in module graphistry.feature\_utils*), 76  
 connected() (*graphistry.layout.graph.graph.Graph method*), 108  
 constant\_function() (*graphistry.layout.graph.graphBase.GraphBase method*), 109  
 contains\_\_cmp\_\_() (*graphistry.layout.utils.poset.Poset method*), 114  
 contract() (*graphistry.layout.graph.graphBase.GraphBase method*), 109  
 copy() (*graphistry.layout.utils.poset.Poset method*), 114  
 create\_and\_post\_file() (*graphistry.ArrowFileUploader.ArrowFileUploader method*), 103  
 create\_dataset() (*graphistry.arrow\_uploader.ArrowUploader*)

method), 99

create\_file() (graphistry.ArrowFileUploader.ArrowFileUploader method), 103

crossings (graphistry.layout.utils.layer.Layer attribute), 113

## D

data (graphistry.layout.graph.edge.Edge attribute), 107

dataset\_id() (graphistry.arrow\_uploader.ArrowUploader property), 99

dbscan() (graphistry.compute.cluster.ClusterMixin method), 93

dbscan\_fit() (in module graphistry.compute.cluster), 95

dbscan\_predict() (in module graphistry.compute.cluster), 96

deepcopy() (graphistry.layout.utils.poset.Poset method), 114

deg\_avg() (graphistry.layout.graph.graph.Graph method), 108

deg\_avg() (graphistry.layout.graph.graphBase.GraphBase method), 109

deg\_max() (graphistry.layout.graph.graph.Graph method), 108

deg\_max() (graphistry.layout.graph.graphBase.GraphBase method), 109

deg\_min() (graphistry.layout.graph.graph.Graph method), 108

deg\_min() (graphistry.layout.graph.graphBase.GraphBase method), 109

degree (graphistry.layout.graph.edge.Edge attribute), 107

degree (graphistry.layout.graph.edgeBase.EdgeBase attribute), 108

degree() (graphistry.layout.graph.vertexBase.VertexBase method), 111

description() (graphistry.arrow\_uploader.ArrowUploader property), 99

detach() (graphistry.layout.graph.edge.Edge method), 107

detach() (graphistry.layout.graph.vertexBase.VertexBase method), 111

DF\_TO\_FILE\_ID\_CACHE (in module graphistry.ArrowFileUploader), 104

df\_to\_gdf() (in module graphistry.plugins.cugraph), 39

dft() (graphistry.layout.graph.graphBase.GraphBase method), 109

difference() (graphistry.layout.utils.poset.Poset method), 114

dijkstra() (graphistry.layout.graph.graphBase.GraphBase method), 109

DummyVertex (class in graphistry.layout.utils.dummyVertex), 112

## E

e\_dir() (graphistry.layout.graph.vertexBase.VertexBase method), 111

e\_from() (graphistry.layout.graph.vertexBase.VertexBase method), 111

e\_in() (graphistry.layout.graph.vertexBase.VertexBase method), 111

e\_out() (graphistry.layout.graph.vertexBase.VertexBase method), 111

e\_to() (graphistry.layout.graph.vertexBase.VertexBase method), 111

e\_with() (graphistry.layout.graph.vertexBase.VertexBase method), 111

Edge (class in graphistry.layout.graph.edge), 107

edge\_encodings() (graphistry.arrow\_uploader.ArrowUploader property), 100

EdgeBase (class in graphistry.layout.graph.edgeBase), 108

edges() (graphistry.arrow\_uploader.ArrowUploader property), 100

edges() (graphistry.layout.graph.graph.Graph method), 108

edges() (graphistry.layout.graph.graphBase.GraphBase method), 109

EdgeViewer (class in graphistry.layout.utils.routing), 114

Embedding (class in graphistry.feature\_utils), 69

encode\_edges() (in module graphistry.feature\_utils), 76

encode\_multi\_target() (in module graphistry.feature\_utils), 76

encode\_textual() (in module graphistry.feature\_utils), 76

eps() (graphistry.layout.graph.graph.Graph method), 108

eps() (graphistry.layout.graph.graphBase.GraphBase method), 109

## F

FastEncoder (class in graphistry.feature\_utils), 69

FastMLB (class in graphistry.feature\_utils), 70

FeatureMixin (class in graphistry.feature\_utils), 70

features\_without\_target() (in module graphistry.feature\_utils), 76

featurize() (graphistry.feature\_utils.FeatureMixin method), 70

feedback (graphistry.layout.graph.edge.Edge attribute), 107

file\_id (graphistry.ArrowFileUploader.MemoizedFileUpload attribute), 104

filter\_weighted\_edges() (graphistry.umap\_utils.UMAPMixin method), 87

`find_bad_set_columns()` (in module `graphistry.feature_utils`), 77  
`fit()` (`graphistry.feature_utils.Embedding` method), 69  
`fit()` (`graphistry.feature_utils.FastEncoder` method), 69  
`fit()` (`graphistry.feature_utils.FastMLB` method), 70  
`fit_pipeline()` (in module `graphistry.feature_utils`), 77  
`fit_transform()` (`graphistry.feature_utils.Embedding` method), 69  
`fit_transform()` (`graphistry.feature_utils.FastEncoder` method), 69  
`from_cugraph()` (in module `graphistry.plugins.cugraph`), 39  
`from_igraph()` (in module `graphistry.plugins.igraph`), 36

## G

`g_to_edge_bindings()` (`graphistry.arrow_uploader.ArrowUploader` method), 100  
`g_to_edge_encodings()` (`graphistry.arrow_uploader.ArrowUploader` method), 100  
`g_to_node_bindings()` (`graphistry.arrow_uploader.ArrowUploader` method), 100  
`g_to_node_encodings()` (`graphistry.arrow_uploader.ArrowUploader` method), 100  
`get()` (`graphistry.layout.utils.poset.Poset` method), 114  
`get_cardinality_ratio()` (in module `graphistry.feature_utils`), 77  
`get_config()` (in module `graphistry._version`), 105  
`get_dataframe_by_column_dtype()` (in module `graphistry.feature_utils`), 77  
`get_feature_names_in()` (`graphistry.feature_utils.FastMLB` method), 70  
`get_feature_names_out()` (`graphistry.feature_utils.FastMLB` method), 70  
`get_keywords()` (in module `graphistry._version`), 105  
`get_matrix()` (`graphistry.feature_utils.FeatureMixin` method), 72  
`get_matrix_by_column_part()` (in module `graphistry.feature_utils`), 77  
`get_matrix_by_column_parts()` (in module `graphistry.feature_utils`), 77  
`get_model_matrix()` (in module `graphistry.compute.cluster`), 96  
`get_numeric_transformers()` (in module `graphistry.feature_utils`), 77  
`get_preprocessing_pipeline()` (in module `graphistry.feature_utils`), 77  
`get_scs_with_feedback()` (`graphistry.layout.graph.graphBase.GraphBase` method), 109  
`get_text_preprocessor()` (in module `graphistry.feature_utils`), 78  
`get_textual_columns()` (in module `graphistry.feature_utils`), 78  
`get_versions()` (in module `graphistry._version`), 105  
`get_vertex_from_data()` (`graphistry.layout.graph.graph.Graph` method), 108  
`get_vertices_count()` (`graphistry.layout.graph.graph.Graph` method), 108  
`git_get_keywords()` (in module `graphistry._version`), 105  
`git_pieces_from_vcs()` (in module `graphistry._version`), 105  
`git_versions_from_keywords()` (in module `graphistry._version`), 105  
`Graph` (class in `graphistry.layout.graph.graph`), 108  
`GraphBase` (class in `graphistry.layout.graph.graphBase`), 109  
`graphistry._version` module, 105  
`graphistry.arrow_uploader` module, 99  
`graphistry.ArrowFileUploader` module, 103  
`graphistry.compute.cluster` module, 93  
`graphistry.feature_utils` module, 69  
`graphistry.layout.graph` module, 111  
`graphistry.layout.graph.edge` module, 107  
`graphistry.layout.graph.edgeBase` module, 108  
`graphistry.layout.graph.graph` module, 108  
`graphistry.layout.graph.graphBase` module, 109  
`graphistry.layout.graph.vertex` module, 110  
`graphistry.layout.graph.vertexBase` module, 111  
`graphistry.layout.utils` module, 115  
`graphistry.layout.utils.dummyVertex` module, 112  
`graphistry.layout.utils.geometry` module, 112

<code>graphistry.layout.utils.layer</code> module, 113	<code>LayoutVertex</code> (class in <code>graphistry.layout.utils.layoutVertex</code> ), 113
<code>graphistry.layout.utils.layoutVertex</code> module, 113	<code>lazy_cudf_import_has_dependancy()</code> (in module <code>graphistry.compute.cluster</code> ), 96
<code>graphistry.layout.utils.poset</code> module, 114	<code>lazy_cudf_import_has_dependancy()</code> (in module <code>graphistry.umap_utils</code> ), 90
<code>graphistry.layout.utils.rectangle</code> module, 114	<code>lazy_cumml_import_has_dependancy()</code> (in module <code>graphistry.umap_utils</code> ), 90
<code>graphistry.layout.utils.routing</code> module, 114	<code>lazy_dbscan_import_has_dependency()</code> (in module <code>graphistry.compute.cluster</code> ), 96
<code>graphistry.plugins.cugraph</code> module, 38	<code>lazy_import_has_dependancy_text()</code> (in module <code>graphistry.feature_utils</code> ), 79
<code>graphistry.plugins.igraph</code> module, 35	<code>lazy_import_has_min_dependancy()</code> (in mod- ule <code>graphistry.feature_utils</code> ), 79
<code>graphistry.plugins_types</code> module, 115	<code>lazy_umap_import_has_dependancy()</code> (in module <code>graphistry.umap_utils</code> ), 90
<code>graphistry.plugins_types.cugraph_types</code> module, 115	<code>leaves()</code> ( <code>graphistry.layout.graph.graphBase.GraphBase</code> method), 110
<code>graphistry.text_utils</code> module, 91	<code>lines_intersection()</code> (in module <code>graphistry.layout.utils.geometry</code> ), 112
<code>graphistry.umap_utils</code> module, 87	<code>load_search_instance()</code> ( <code>graphistry.text_utils.SearchToGraphMixin</code> class method), 91
<code>group_columns_by_dtypes()</code> (in module <code>graphistry.feature_utils</code> ), 78	<code>login()</code> ( <code>graphistry.arrow_uploader.ArrowUploader</code> method), 100
<b>I</b>	<code>lower</code> ( <code>graphistry.layout.utils.layer.Layer</code> attribute), 113
<code>identity()</code> (in module <code>graphistry.feature_utils</code> ), 78	<b>M</b>
<code>impute_and_scale_df()</code> (in module <code>graphistry.feature_utils</code> ), 78	<code>make_array()</code> (in module <code>graphistry.feature_utils</code> ), 79
<code>index()</code> ( <code>graphistry.layout.graph.vertex.Vertex</code> prop- erty), 110	<code>make_safe_gpu_dataframes()</code> (in module <code>graphistry.compute.cluster</code> ), 96
<code>index()</code> ( <code>graphistry.layout.utils.poset.Poset</code> method), 114	<code>make_safe_gpu_dataframes()</code> (in module <code>graphistry.umap_utils</code> ), 90
<code>inner()</code> ( <code>graphistry.layout.utils.dummyVertex.DummyVertex</code> method), 112	<code>matrix()</code> ( <code>graphistry.layout.graph.graphBase.GraphBase</code> method), 110
<code>intersection()</code> ( <code>graphistry.layout.utils.poset.Poset</code> method), 114	<code>maybe_bindings()</code> ( <code>graphistry.arrow_uploader.ArrowUploader</code> method), 100
<code>is_dataframe_all_numeric()</code> (in module <code>graphistry.feature_utils</code> ), 79	<code>maybe_post_share_link()</code> ( <code>graphistry.arrow_uploader.ArrowUploader</code> method), 100
<code>is_legacy_cumml()</code> (in module <code>graphistry.umap_utils</code> ), 90	<code>MemoizedFileUpload</code> (class in <code>graphistry.ArrowFileUploader</code> ), 104
<code>issubset()</code> ( <code>graphistry.layout.utils.poset.Poset</code> method), 114	<code>metadata()</code> ( <code>graphistry.arrow_uploader.ArrowUploader</code> property), 100
<code>issuperset()</code> ( <code>graphistry.layout.utils.poset.Poset</code> method), 114	module
<b>L</b>	<code>graphistry._version</code> , 105
<code>Layer</code> (class in <code>graphistry.layout.utils.layer</code> ), 113	<code>graphistry.arrow_uploader</code> , 99
<code>layout</code> ( <code>graphistry.layout.utils.layer.Layer</code> attribute), 113	<code>graphistry.ArrowFileUploader</code> , 103
<code>layout_cugraph()</code> (in module <code>graphistry.plugins.cugraph</code> ), 39	<code>graphistry.compute.cluster</code> , 93
<code>layout_igraph()</code> (in module <code>graphistry.plugins.igraph</code> ), 37	<code>graphistry.feature_utils</code> , 69
	<code>graphistry.layout.graph</code> , 111
	<code>graphistry.layout.graph.edge</code> , 107



[graphistry.layout.graph.edgeBase](#), 108  
[graphistry.layout.graph.graph](#), 108  
[graphistry.layout.graph.graphBase](#), 109  
[graphistry.layout.graph.vertex](#), 110  
[graphistry.layout.graph.vertexBase](#), 111  
[graphistry.layout.utils](#), 115  
[graphistry.layout.utils.dummyVertex](#), 112  
[graphistry.layout.utils.geometry](#), 112  
[graphistry.layout.utils.layer](#), 113  
[graphistry.layout.utils.layoutVertex](#), 113  
[graphistry.layout.utils.poset](#), 114  
[graphistry.layout.utils.rectangle](#), 114  
[graphistry.layout.utils.routing](#), 114  
[graphistry.plugins.cugraph](#), 38  
[graphistry.plugins.igraph](#), 35  
[graphistry.plugins\\_types](#), 115  
[graphistry.plugins\\_types.cugraph\\_types](#), 115  
[graphistry.text\\_utils](#), 91  
[graphistry.umap\\_utils](#), 87

## N

[N\(\)](#) ([graphistry.layout.graph.graph.Graph](#) method), 108  
[N\(\)](#) ([graphistry.layout.graph.graphBase.GraphBase](#) method), 109  
[name\(\)](#) ([graphistry.arrow\\_uploader.ArrowUploader](#) property), 100  
[neighbors\(\)](#) ([graphistry.layout.graph.vertexBase.VertexBase](#) method), 111  
[neighbors\(\)](#) ([graphistry.layout.utils.dummyVertex.DummyVertex](#) method), 112  
[neighbors\(\)](#) ([graphistry.layout.utils.layer.Layer](#) method), 113  
[new\\_point\\_at\\_distance\(\)](#) (in module [graphistry.layout.utils.geometry](#)), 112  
[nextlayer\(\)](#) ([graphistry.layout.utils.layer.Layer](#) method), 113  
[node\\_encodings\(\)](#) ([graphistry.arrow\\_uploader.ArrowUploader](#) property), 100  
[nodes\(\)](#) ([graphistry.arrow\\_uploader.ArrowUploader](#) property), 100  
[norm\(\)](#) ([graphistry.layout.graph.graph.Graph](#) method), 108  
[norm\(\)](#) ([graphistry.layout.graph.graphBase.GraphBase](#) method), 110  
[NotThisMethod](#), 105

## O

[order\(\)](#) ([graphistry.layout.graph.graph.Graph](#) method), 108  
[order\(\)](#) ([graphistry.layout.graph.graphBase.GraphBase](#) method), 110  
[order\(\)](#) ([graphistry.layout.utils.layer.Layer](#) method), 113  
[org\\_name\(\)](#) ([graphistry.arrow\\_uploader.ArrowUploader](#) property), 100  
[output](#) ([graphistry.ArrowFileUploader.MemoizedFileUpload](#) attribute), 104

## P

[partition\(\)](#) ([graphistry.layout.graph.graphBase.GraphBase](#) method), 110  
[passthrough\\_df\\_cols\(\)](#) (in module [graphistry.feature\\_utils](#)), 79  
[path\(\)](#) ([graphistry.layout.graph.graph.Graph](#) method), 108  
[path\(\)](#) ([graphistry.layout.graph.graphBase.GraphBase](#) method), 110  
[pkey\\_login\(\)](#) ([graphistry.arrow\\_uploader.ArrowUploader](#) method), 100  
[plus\\_or\\_dot\(\)](#) (in module [graphistry.\\_version](#)), 105  
[Poset](#) (class in [graphistry.layout.utils.poset](#)), 114  
[post\(\)](#) ([graphistry.arrow\\_uploader.ArrowUploader](#) method), 100  
[post\\_arrow\(\)](#) ([graphistry.arrow\\_uploader.ArrowUploader](#) method), 100  
[post\\_arrow\(\)](#) ([graphistry.ArrowFileUploader.ArrowFileUploader](#) method), 104  
[post\\_arrow\\_generic\(\)](#) ([graphistry.arrow\\_uploader.ArrowUploader](#) method), 100  
[post\\_edges\\_arrow\(\)](#) ([graphistry.arrow\\_uploader.ArrowUploader](#) method), 101  
[post\\_edges\\_file\(\)](#) ([graphistry.arrow\\_uploader.ArrowUploader](#) method), 101  
[post\\_file\(\)](#) ([graphistry.arrow\\_uploader.ArrowUploader](#) method), 101  
[post\\_g\(\)](#) ([graphistry.arrow\\_uploader.ArrowUploader](#) method), 101  
[post\\_nodes\\_arrow\(\)](#) ([graphistry.arrow\\_uploader.ArrowUploader](#) method), 101  
[post\\_nodes\\_file\(\)](#) ([graphistry.arrow\\_uploader.ArrowUploader](#) method), 101  
[post\\_share\\_link\(\)](#) ([graphistry.arrow\\_uploader.ArrowUploader](#) method), 101

```

prevlayer() (in module graphistry.layout.utils.layer.Layer method), 113
process_dirty_dataframes() (in module graphistry.feature_utils), 79
process_edge_dataframes() (in module graphistry.feature_utils), 79
process_nodes_dataframes() (in module graphistry.feature_utils), 81
prune_weighted_edges_df_and_relabel_nodes() (in module graphistry.feature_utils), 82

```

## R

```

Rectangle (class in graphistry.layout.utils.rectangle), 114
rectangle_point_intersection() (in module graphistry.layout.utils.geometry), 112
refresh() (graphistry.arrow_uploader.ArrowUploader method), 101
register_vcs_handler() (in module graphistry._version), 105
remove() (graphistry.layout.utils.poset.Poset method), 114
remove_edge() (graphistry.layout.graph.graph.Graph method), 109
remove_edge() (graphistry.layout.graph.graphBase.GraphBase method), 110
remove_internal_namespace_if_present() (in module graphistry.feature_utils), 82
remove_node_column_from_symbolic() (in module graphistry.feature_utils), 83
remove_vertex() (graphistry.layout.graph.graph.Graph method), 109
remove_vertex() (graphistry.layout.graph.graphBase.GraphBase method), 110
render() (in module graphistry._version), 105
render_git_describe() (in module graphistry._version), 105
render_git_describe_long() (in module graphistry._version), 105
render_pep440() (in module graphistry._version), 106
render_pep440_old() (in module graphistry._version), 106
render_pep440_post() (in module graphistry._version), 106
render_pep440_pre() (in module graphistry._version), 106
resolve_cpu_gpu_engine() (in module graphistry.compute.cluster), 96
resolve_feature_engine() (in module graphistry.feature_utils), 83
resolve_umap_engine() (in module graphistry.umap_utils), 90
resolve_X() (in module graphistry.feature_utils), 83

```

```

resolve_y() (in module graphistry.feature_utils), 83
reuse_featurization() (in module graphistry.feature_utils), 83
reuse_umap() (in module graphistry.umap_utils), 90
roots() (graphistry.layout.graph.graphBase.GraphBase method), 110
route_with_lines() (in module graphistry.layout.utils.routing), 114
route_with_rounded_corners() (in module graphistry.layout.utils.routing), 114
route_with_splines() (in module graphistry.layout.utils.routing), 114
run_command() (in module graphistry._version), 106

```

## S

```

safe_divide() (in module graphistry.feature_utils), 83
save_search_instance() (graphistry.text_utils.SearchToGraphMixin method), 91
scale() (graphistry.feature_utils.FastEncoder method), 69
scale() (graphistry.feature_utils.FeatureMixin method), 73
search() (graphistry.text_utils.SearchToGraphMixin method), 91
search_graph() (graphistry.text_utils.SearchToGraphMixin method), 92
SearchToGraphMixin (class in graphistry.text_utils), 91
server_base_path() (graphistry.arrow_uploader.ArrowUploader property), 101
set_currency_to_float() (in module graphistry.feature_utils), 83
set_round_corner() (in module graphistry.layout.utils.geometry), 112
set_to_bool() (in module graphistry.feature_utils), 83
set_to_datetime() (in module graphistry.feature_utils), 83
set_to_numeric() (in module graphistry.feature_utils), 84
setcurve() (in module graphistry.layout.utils.geometry), 112
setpath() (graphistry.layout.utils.routing.EdgeViewer method), 114
setup() (graphistry.layout.utils.layer.Layer method), 113
size_median() (in module graphistry.layout.utils.geometry), 112
smart_scaler() (in module graphistry.feature_utils), 84

```

spans() (*graphistry.layout.graph.graphBase.GraphBase method*), 110  
 sso\_get\_token() (*graphistry.arrow\_uploader.ArrowUploader method*), 101  
 sso\_login() (*graphistry.arrow\_uploader.ArrowUploader method*), 101  
 symmetric\_difference() (*graphistry.layout.utils.poset.Poset method*), 114  
 union\_update() (*graphistry.layout.graph.graphBase.GraphBase method*), 110  
 update() (*graphistry.layout.utils.poset.Poset method*), 114  
 uploader (*graphistry.ArrowFileUploader.ArrowFileUploader attribute*), 104  
 upper (*graphistry.layout.utils.layer.Layer attribute*), 113

## T

tangents() (*in module graphistry.layout.utils.geometry*), 112  
 to\_cugraph() (*in module graphistry.plugins.cugraph*), 40  
 to\_igraph() (*in module graphistry.plugins.igraph*), 38  
 token() (*graphistry.arrow\_uploader.ArrowUploader property*), 101  
 transform() (*graphistry.feature\_utils.Embedding method*), 69  
 transform() (*graphistry.feature\_utils.FastEncoder method*), 70  
 transform() (*graphistry.feature\_utils.FastMLB method*), 70  
 transform() (*graphistry.feature\_utils.FeatureMixin method*), 75  
 transform() (*in module graphistry.feature\_utils*), 84  
 transform\_dbscan() (*graphistry.compute.cluster.ClusterMixin method*), 94  
 transform\_dirty() (*in module graphistry.feature\_utils*), 84  
 transform\_scaled() (*graphistry.feature\_utils.FastEncoder method*), 70  
 transform\_text() (*in module graphistry.feature\_utils*), 84  
 transform\_umap() (*graphistry.umap\_utils.UMAPMixin method*), 87

## U

umap() (*graphistry.umap\_utils.UMAPMixin method*), 88  
 umap\_fit() (*graphistry.umap\_utils.UMAPMixin method*), 89  
 umap\_graph\_to\_weighted\_edges() (*in module graphistry.umap\_utils*), 90  
 umap\_lazy\_init() (*graphistry.umap\_utils.UMAPMixin method*), 90  
 UMAPMixin (*class in graphistry.umap\_utils*), 87  
 union() (*graphistry.layout.utils.poset.Poset method*), 114

## V

verify() (*graphistry.arrow\_uploader.ArrowUploader method*), 101  
 VersioneerConfig (*class in graphistry.\_version*), 105  
 versions\_from\_parentdir() (*in module graphistry.\_version*), 106  
 Vertex (*class in graphistry.layout.graph.vertex*), 110  
 VertexBase (*class in graphistry.layout.graph.vertexBase*), 111  
 vertices() (*graphistry.layout.graph.graph.Graph method*), 109  
 vertices() (*graphistry.layout.graph.graphBase.GraphBase method*), 110  
 view\_base\_path() (*graphistry.arrow\_uploader.ArrowUploader property*), 101

## W

w (*graphistry.layout.graph.edge.Edge attribute*), 107  
 where\_is\_currency\_column() (*in module graphistry.feature\_utils*), 85  
 WrappedTable (*class in graphistry.ArrowFileUploader*), 104