mplot3d tutorial

Contents

Getting started

An Axes3D object is created just like any other axes using the projection='3d' keyword. Create a new `matplotlib.figure.Figure` and add a new axes to it of type `Axes3D`:

```
import matplotlib.pyplot as plt
from mpl_toolkits.mplot3d import Axes3D
fig = plt.figure()
ax = fig.add_subplot(111, projection='3d')
```

New in version 1.0.0: This approach is the preferred method of creating a 3D axes.

Note

Prior to version 1.0.0, the method of creating a 3D axes was different. For those using older versions of matplotlib, change `ax = fig.add_subplot(111, projection='3d')` to `ax = Axes3D(fig)`.

Line plots

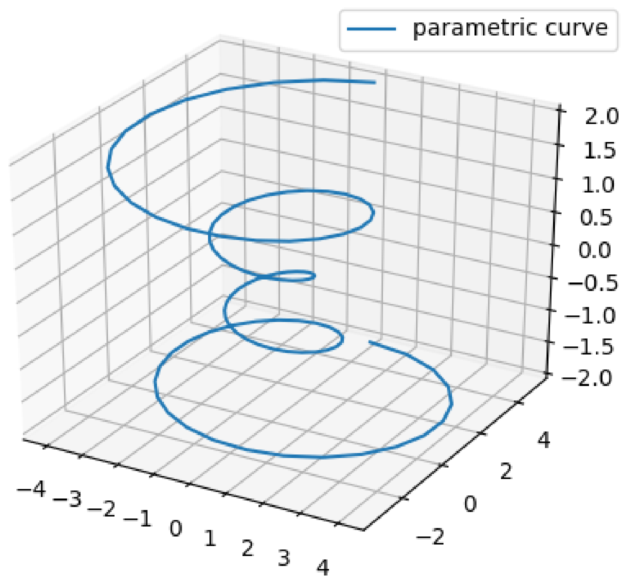
`Axes3D.plot(xs, ys, *args, **kwargs)`

Plot 2D or 3D data.

Argument	Description
xs, ys	x, y coordinates of vertices
zs	z value(s), either one for all points or one for each point.
zdir	Which direction to use as z ('x', 'y' or 'z') when plotting a 2D set.

Other arguments are passed on to `plot()`

(Source code, png, pdf)



Scatter plots

```
Axes3D.scatter(xs, ys, zs=0, zdir='z', s=20, c=None, depthshade=True, *args, **kwargs)
```

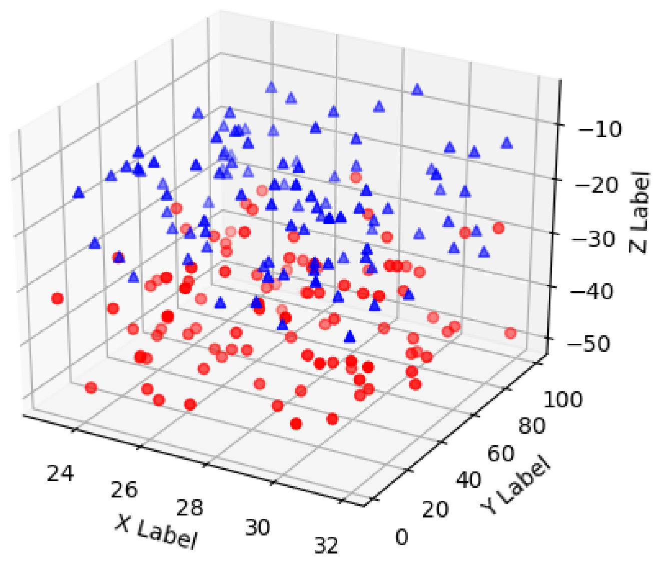
Create a scatter plot.

Argument	Description
xs, *ys*	Positions of data points.
zs	Either an array of the same length as *xs* and *ys* or a single value to place all points in the same plane. Default is 0.
zdir	Which direction to use as z ('x', 'y' or 'z') when plotting a 2D set.
s	Size in points^2. It is a scalar or an array of the same length as *x* and *y*.
c	A color. *c* can be a single color format string, or a sequence of color specifications of length *N*, or a sequence of *N* numbers to be mapped to colors using the *cmap* and *norm* specified via kwargs (see below). Note that *c* should not be a single numeric RGB or RGBA sequence because that is indistinguishable from an array of values to be colormapped. *c* can be a 2-D array in which the rows are RGB or RGBA, however, including the case of a single row to specify the same color for all points.
depthshade	Whether or not to shade the scatter markers to give the appearance of depth. Default is *True*.

Keyword arguments are passed on to `scatter()`.

Returns a `Patch3DCollection`

(Source code, png, pdf)



Wireframe plots

`Axes3D.plot_wireframe(X, Y, Z, *args, **kwargs)`

Plot a 3D wireframe.

The `rstride` and `cstride` kwargs set the stride used to sample the input data to generate the graph. If either is 0 the input data in not sampled along this direction producing a 3D line plot rather than a wireframe plot. The stride arguments are only used by default if in the 'classic' mode. They are now superseded by `rcount` and `ccount`. Will raise ValueError if both stride and count are used.

` The `rcount` and `ccount` kwargs supersedes `rstride` and

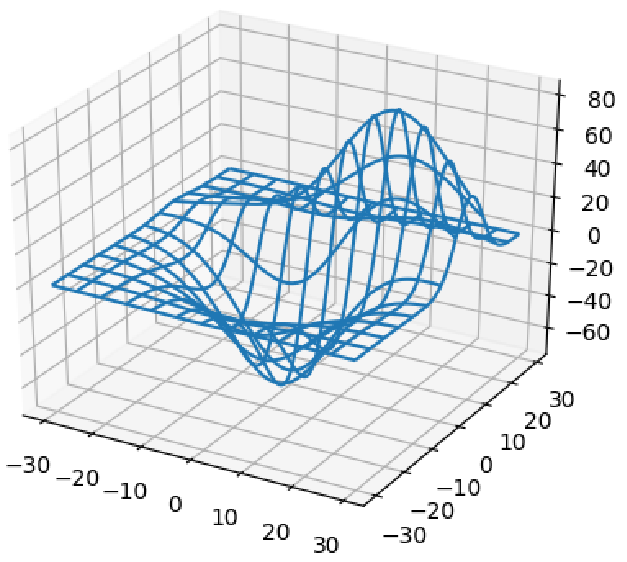
`cstride` for default sampling method for wireframe plotting. These arguments will determine at most how many evenly spaced samples will be taken from the input data to generate the graph. This is the default sampling method unless using the 'classic' style. Will raise ValueError if both stride and count are specified. If either is zero, then the input data is not sampled along this direction, producing a 3D line plot rather than a wireframe plot. Added in v2.0.0.

Argument	Description
X, *Y*,	Data values as 2D arrays
Z	
rstride	Array row stride (step size), defaults to 1
cstride	Array column stride (step size), defaults to 1
rcount	Use at most this many rows, defaults to 50
ccount	Use at most this many columns, defaults to 50

Keyword arguments are passed on to `LineCollection`.

Returns a `Line3DCollection`

(Source code, png, pdf)



Surface plots

`Axes3D.plot_surface(X, Y, Z, *args, **kwargs)`

Create a surface plot.

By default it will be colored in shades of a solid color, but it also supports color mapping by supplying the *cmap* argument.

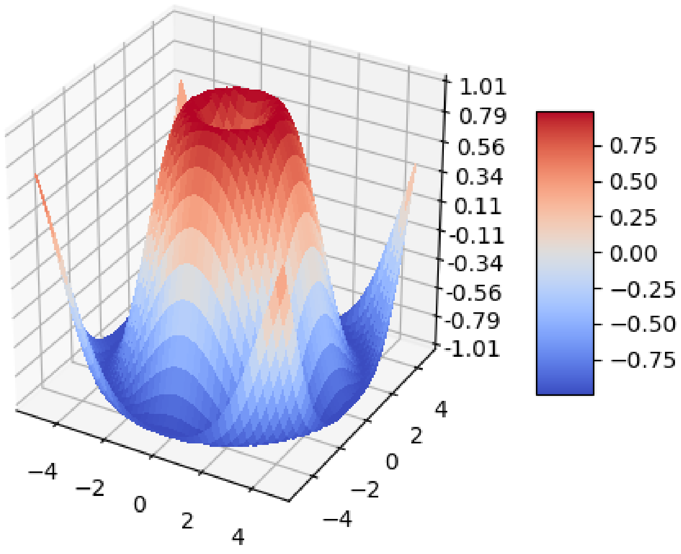
The `rstride` and `cstride` kwargs set the stride used to sample the input data to generate the graph. If 1k by 1k arrays are passed in, the default values for the strides will result in a 100x100 grid being plotted. Defaults to 10. Raises a ValueError if both stride and count kwargs (see next section) are provided.

The `rcount` and `ccount` kwargs supersedes `rstride` and `cstride` for default sampling method for surface plotting. These arguments will determine at most how many evenly spaced samples will be taken from the input data to generate the graph. This is the default sampling method unless using the 'classic' style. Will raise ValueError if both stride and count are specified. Added in v2.0.0.

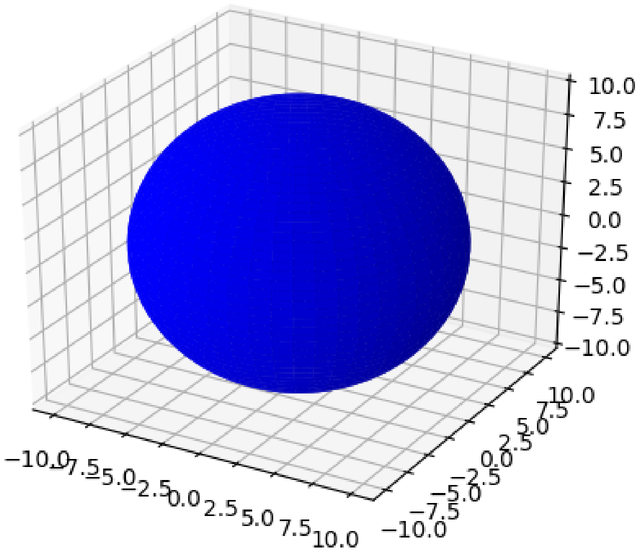
Argument	Description
X, *Y*, *Z*	Data values as 2D arrays
rstride	Array row stride (step size)
cstride	Array column stride (step size)
rcount	Use at most this many rows, defaults to 50
ccount	Use at most this many columns, defaults to 50
color	Color of the surface patches
cmap	A colormap for the surface patches.
facecolors	Face colors for the individual patches
norm	An instance of Normalize to map values to colors
vmin	Minimum value to map
vmax	Maximum value to map
shade	Whether to shade the facecolors

Other arguments are passed on to `Poly3DCollection`

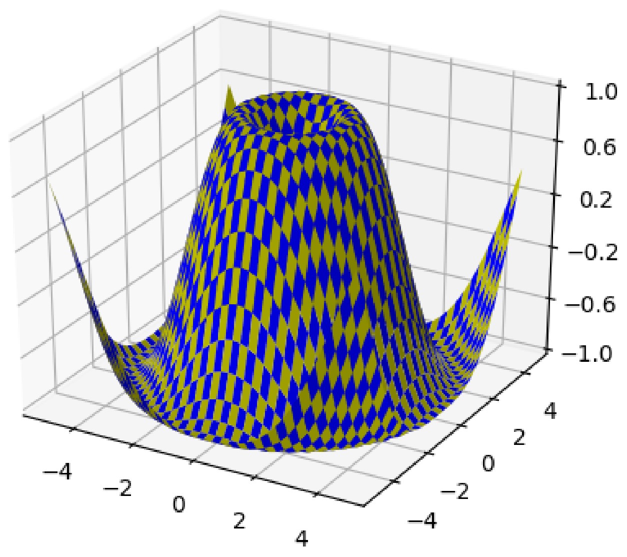
(Source code, png, pdf)



(Source code, png, pdf)



(Source code, png, pdf)



Tri-Surface plots

`Axes3D.plot_trisurf(*args, **kwargs)`

Argument	Description
X, *Y*, *Z*	Data values as 1D arrays
color	Color of the surface patches
cmap	A colormap for the surface patches.
norm	An instance of Normalize to map values to colors
vmin	Minimum value to map
vmax	Maximum value to map
shade	Whether to shade the facecolors

The (optional) triangulation can be specified in one of two ways; either:

```
plot_trisurf(triangulation, ...)
```

where triangulation is a `Triangulation` object, or:

```
plot_trisurf(X, Y, ...)
plot_trisurf(X, Y, triangles, ...)
plot_trisurf(X, Y, triangles=triangles, ...)
```

in which case a Triangulation object will be created. See `Triangulation` for a explanation of these possibilities.

The remaining arguments are:

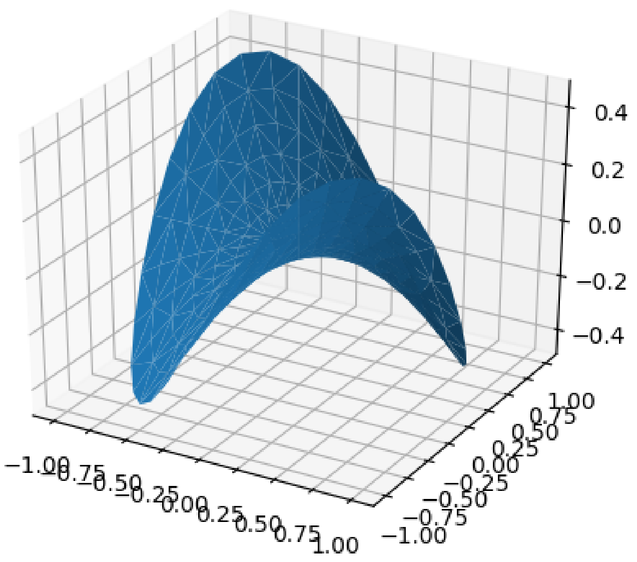
```
plot_trisurf(..., Z)
```

where *Z* is the array of values to contour, one per point in the triangulation.

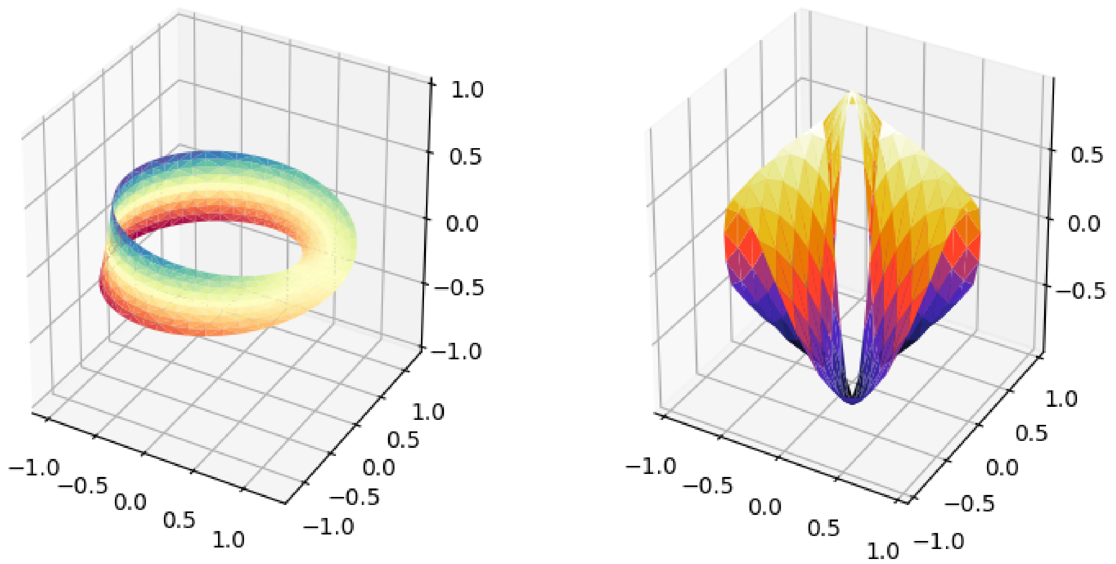
Other arguments are passed on to `Poly3DCollection`

Examples:

(Source code, png, pdf)

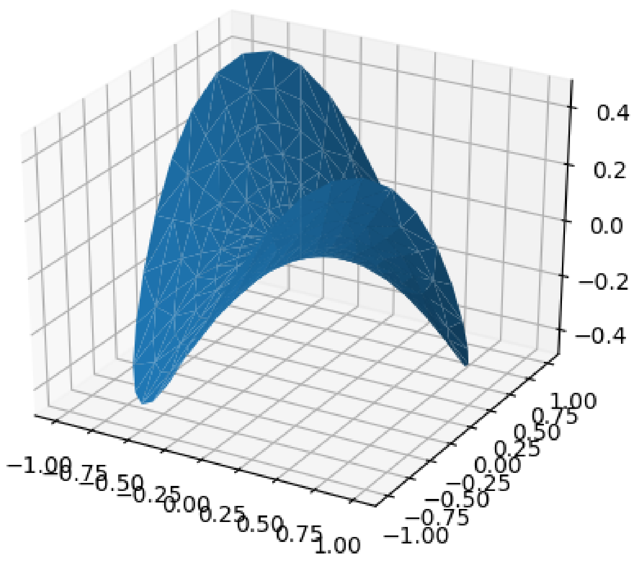


(Source code, png, pdf)



New in version 1.2.0: This plotting function was added for the v1.2.0 release.

(Source code, png, pdf)



Contour plots

`Axes3D.contour(X, Y, Z, *args, **kwargs)`

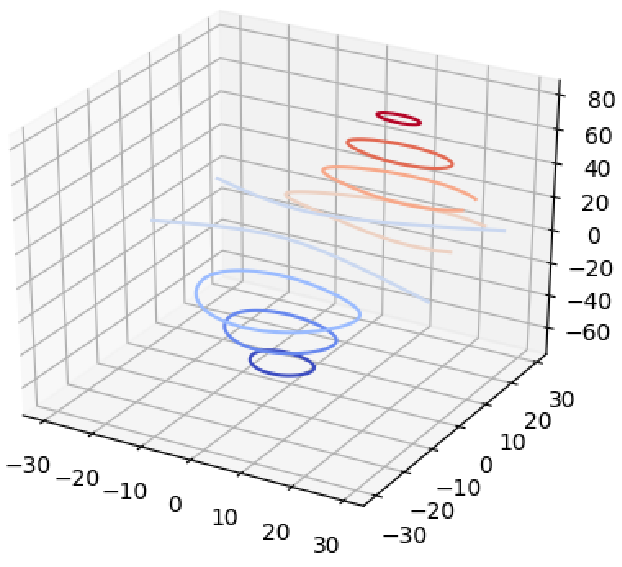
Create a 3D contour plot.

Argument	Description
X, *Y*,	Data values as numpy.arrays
Z	
extend3d	Whether to extend contour in 3D (default: False)
stride	Stride (step size) for extending contour
zdir	The direction to use: x, y or z (default)
offset	If specified plot a projection of the contour lines on this position in plane normal to zdir

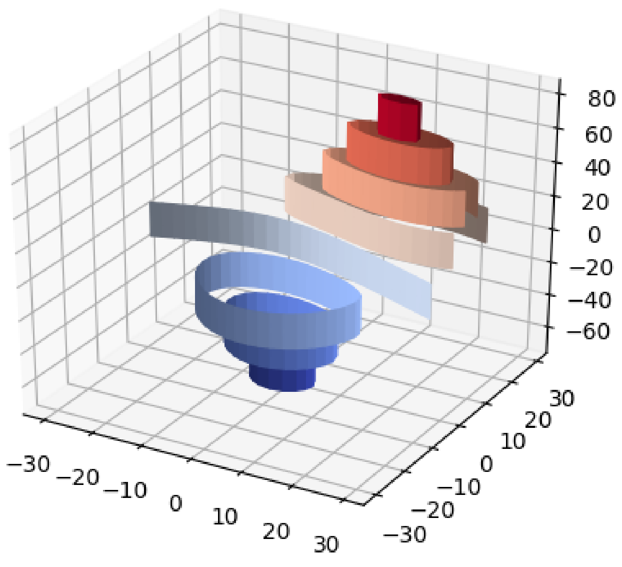
The positional and other keyword arguments are passed on to `contour()`

Returns a `contour`

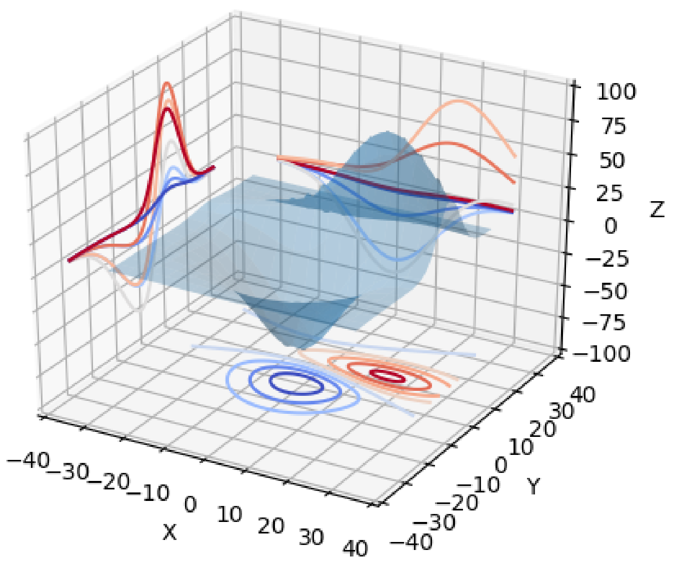
(Source code, png, pdf)



(Source code, png, pdf)



(Source code, png, pdf)



Filled contour plots

`Axes3D.contourf(X, Y, Z, *args, **kwargs)`

Create a 3D contourf plot.

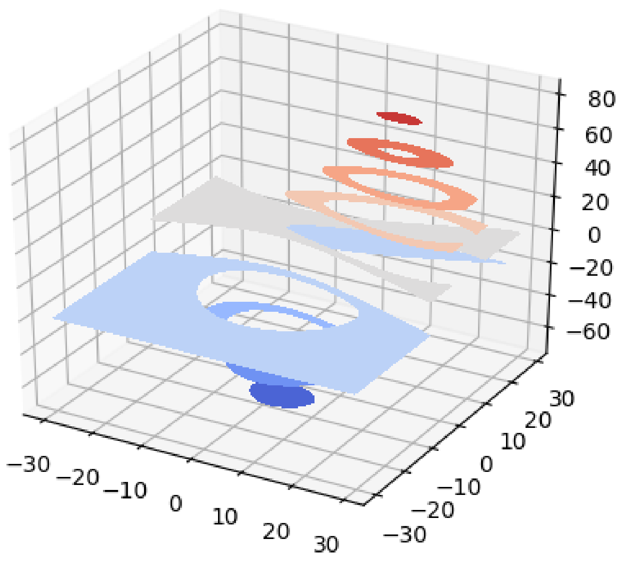
Argument	Description
X, *Y*,	Data values as numpy.arrays
Z	
zdir	The direction to use: x, y or z (default)
offset	If specified plot a projection of the filled contour on this position in plane normal to zdir

The positional and keyword arguments are passed on to `contourf()`

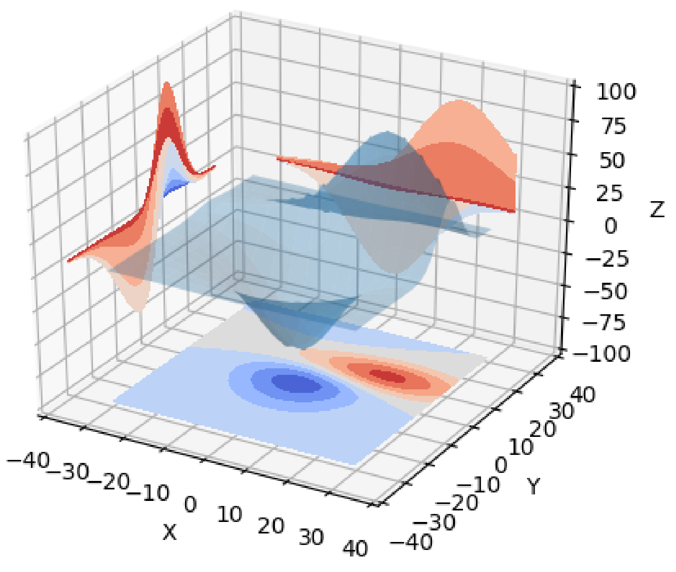
Returns a `contourf`

Changed in version 1.1.0: The *zdir* and *offset* kwargs were added.

(Source code, png, pdf)



(Source code, png, pdf)



New in version 1.1.0: The feature demoed in the second contourf3d example was enabled as a result of a bugfix for version 1.1.0.

Polygon plots

`Axes3D.add_collection3d(col, zs=0, zdir='z')`

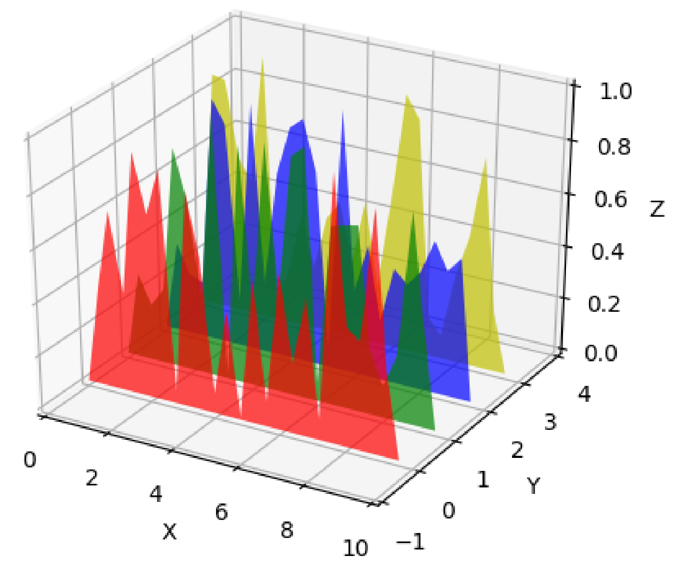
Add a 3D collection object to the plot.

2D collection types are converted to a 3D version by modifying the object and adding z coordinate information.

Supported are:

- PolyCollection
- LineColleciton
- PatchCollection

(Source code, png, pdf)



Bar plots

`Axes3D.bar(left, height, zs=0, zdir='z', *args, **kwargs)`

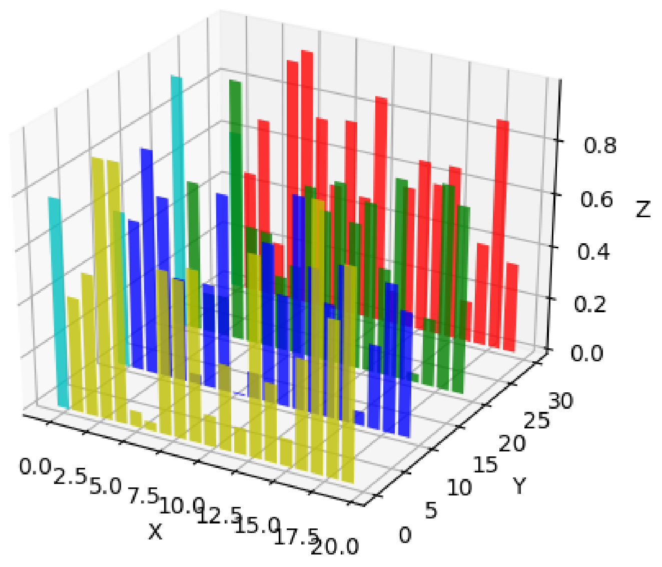
Add 2D bar(s).

Argument	Description
left	The x coordinates of the left sides of the bars.
height	The height of the bars.
zs	Z coordinate of bars, if one value is specified they will all be placed at the same z.
zdir	Which direction to use as z ('x', 'y' or 'z') when plotting a 2D set.

Keyword arguments are passed onto `bar()`.

Returns a `Patch3DCollection`

(Source code, png, pdf)



Quiver

`Axes3D.quiver(*args, **kwargs)`

Plot a 3D field of arrows.

call signatures:

```
quiver(X, Y, Z, U, V, W, **kwargs)
```

Arguments:

X, *Y*, *Z*:

The x, y and z coordinates of the arrow locations (default is tail of arrow; see *pivot* kwarg)

U, *V*, *W*:

The x, y and z components of the arrow vectors

The arguments could be array-like or scalars, so long as they they can be broadcast together. The arguments can also be masked arrays. If an element in any of argument is masked, then that corresponding quiver element will not be plotted.

Keyword arguments:

length: [1.0 | float]

The length of each quiver, default to 1.0, the unit is the same with the axes

arrow_length_ratio: [0.3 | float]

The ratio of the arrow head with respect to the quiver, default to 0.3

pivot: [‘tail’ | ‘middle’ | ‘tip’]

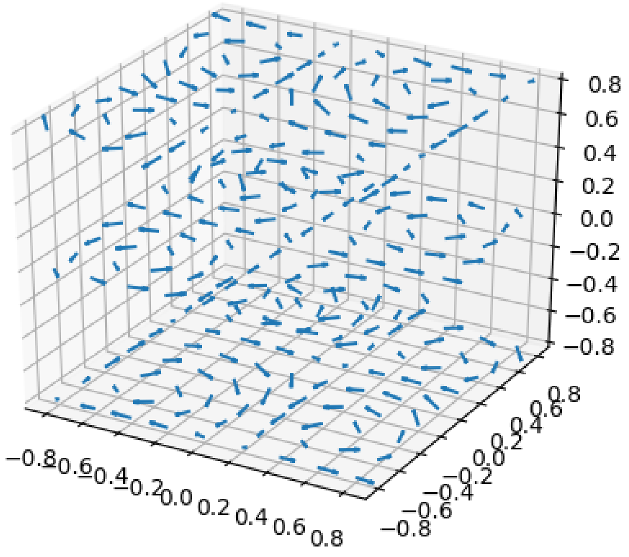
The part of the arrow that is at the grid point; the arrow rotates about this point, hence the name *pivot*. Default is ‘tail’

normalize: [False | True]

When True, all of the arrows will be the same length. This defaults to False, where the arrows will be different lengths depending on the values of u,v,w.

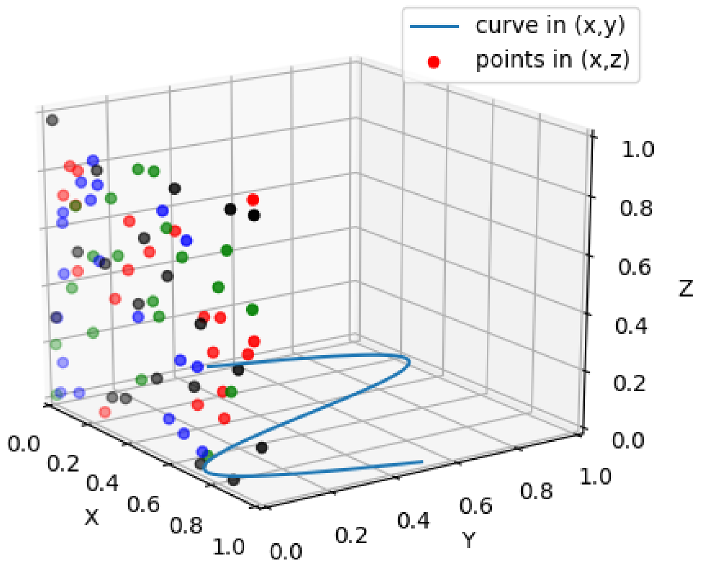
Any additional keyword arguments are delegated to `LineCollection`

(Source code, png, pdf)



2D plots in 3D

(Source code, png, pdf)

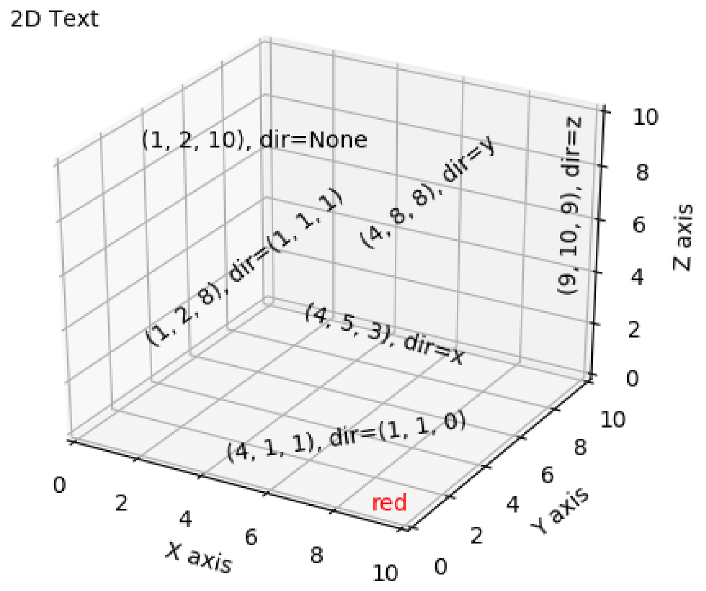


Text

`Axes3D.text(x, y, z, s, zdir=None, **kwargs)`

Add text to the plot. kwargs will be passed on to Axes.text, except for the `zdir` keyword, which sets the direction to be used as the z direction.

(Source code, png, pdf)

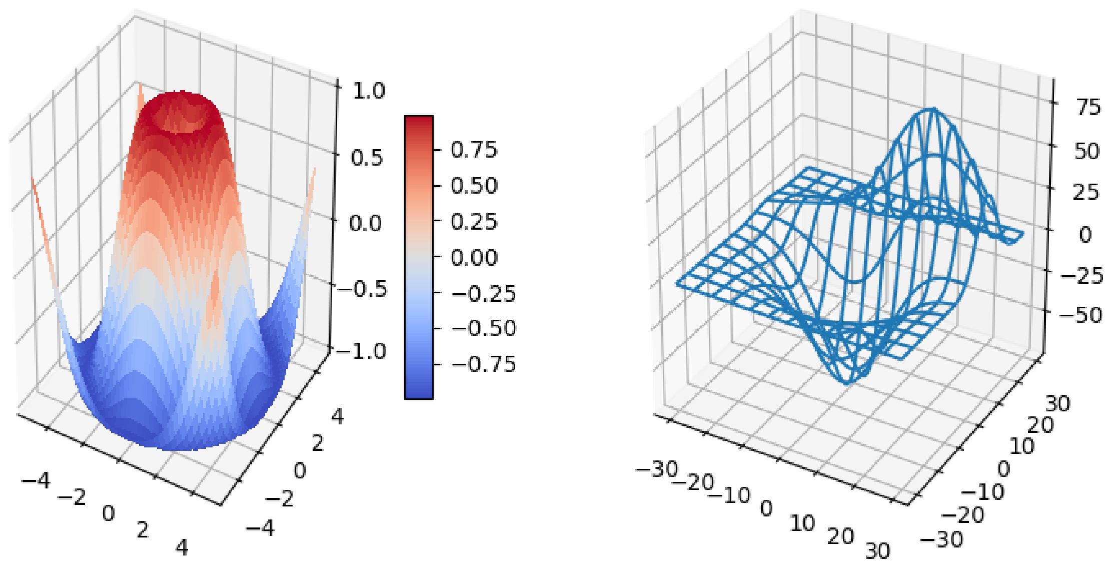


Subplotting

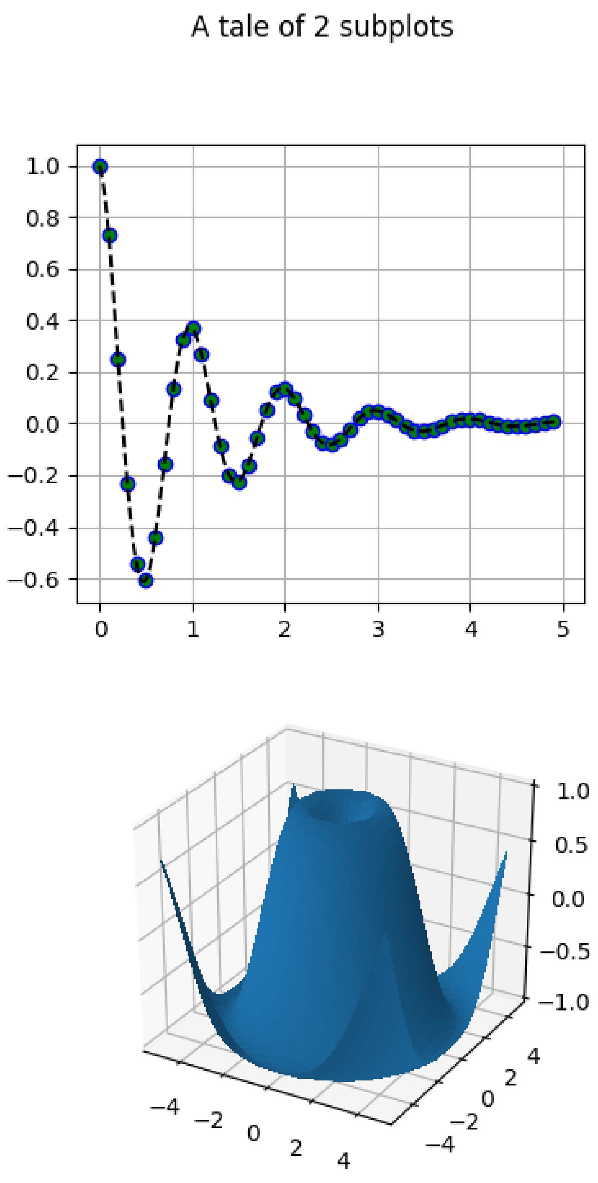
Having multiple 3D plots in a single figure is the same as it is for 2D plots. Also, you can have both 2D and 3D plots in the same figure.

New in version 1.0.0: Subplotting 3D plots was added in v1.0.0. Earlier version can not do this.

(Source code, png, pdf)



(Source code, png, pdf)


A tale of 2 subplots
1.0
0.8
0.6
0.4
0.2
0.0
−0.2
−0.4
−0.6
0
1
2
3
4
5
1.0
0.5
0.0
−0.5
−1.0
−4
−2
0
2
4
4
2
0
−2
−4