0. Less 2?

Contents

…

In case of doubt … it is just a hobby not for “production”

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:local:

\`\`\`

test-Gif-ok

Basciallly

set working directory under Juno is a must!!!

under Juno Connect to my MacMini,

```
it works yesterday but not today, no idea
```

under iPadOS

```
tk and qt does not expect and actually do not work

imshow does not work as GIF display hence use markdown
I have to save the animation into GIF and display using markdown as in here
    under markdown, there is no need of ./ and in fact having those may not work ... tr
```

under MacOS (macmini M1)

```
the display under markdown work
    in MacOS only if it has a directory there like ./ or img/
    otherwise not working
if you run the Gif under safari the Gif is generated correctly though
```

for the option

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```
- Work under MacOS (in seperate windows and has to wait a bit)
- not under ipados
```

-
  ```
  - Work under MacOS (in seperate windows and has to wait a bit)
  - not under ipados
  ```

-
  ```
  - not work under MacOS
  - work but only as non-interactive backend
  ```

    - as default message said the TkAgg is non-interactive and hence cannot plt.show()

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```
# see https://stackoverflow.com/questions/56423221/saving-animated-matplotlib-chart-to-
import os
import numpy as np
import matplotlib.pyplot as plt
import matplotlib.animation as animation

#%matplotlib qt
# %matplotlib tk
%matplotlib

TWOPI = 2*np.pi

fig, ax = plt.subplots()

t = np.arange(0.0, TWOPI, 0.001)
s = np.sin(t)
l = plt.plot(t, s)

ax = plt.axis([0,TWOPI,-1.1,1.1])

redDot, = plt.plot([0], [np.sin(0)], 'ro')

def animate(i):
    '''
    '''
    redDot.set_data(i, np.sin(i))
    # got warning message
    # seems later would not support this
    return redDot,

# create animation using the animate() function with no repeat
myAnimation = animation.FuncAnimation(fig, animate, frames=np.arange(0.0, TWOPI, 0.03),
                                      interval=100, blit=True, repeat=False)

myAnimation.save('test-Gif-ok3U2Alex.gif', writer='pillow', fps=30)
myAnimation.save('img/test-Gif-ok3Alex.gif', writer='pillow', fps=30)



plt.show()

# under iPad
# <ipython-input-8-c07342f6b45b>:59: UserWarning: Matplotlib is currently using TkAgg,
# which is a non-GUI backend, so cannot show the figure. plt.show()
```

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```
Using matplotlib backend: <object object at 0x107eaf330>
```

```
/var/folders/33/krstvgns2rncl74r18tkv6_80000gn/T/ipykernel_32039/3771949022.py:26: Matp
  redDot.set_data(i, np.sin(i))
/var/folders/33/krstvgns2rncl74r18tkv6_80000gn/T/ipykernel_32039/3771949022.py:26: Matp
  redDot.set_data(i, np.sin(i))
```

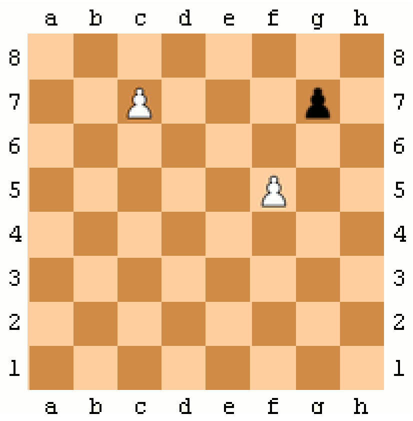
```
/var/folders/33/krstvgns2rncl74r18tkv6_80000gn/T/ipykernel_32039/3771949022.py:26: Matp
  redDot.set_data(i, np.sin(i))
```

```
# in code cell

import matplotlib.pyplot as plt
import matplotlib.image as mpimg

imgU = mpimg.imread("test-Gif-ok3U2Alex.gif") # this work as well
imgA = mpimg.imread("img/test-Gif-ok3Alex.gif") # this work

plt.imshow(imgU)
plt.imshow(imgA)
# only 1 img but if you just do one both work
# but no animation under iPad Juno or MacOS
```

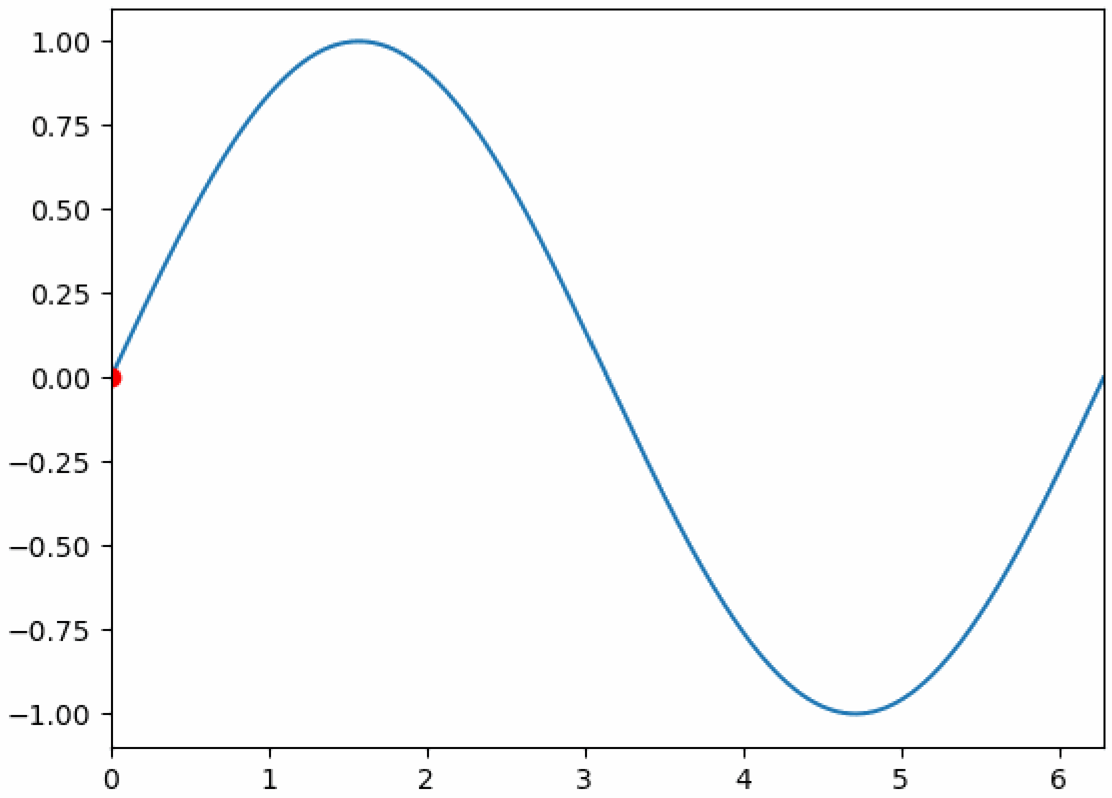
```
<matplotlib.image.AxesImage at 0x11017a450>
```

work

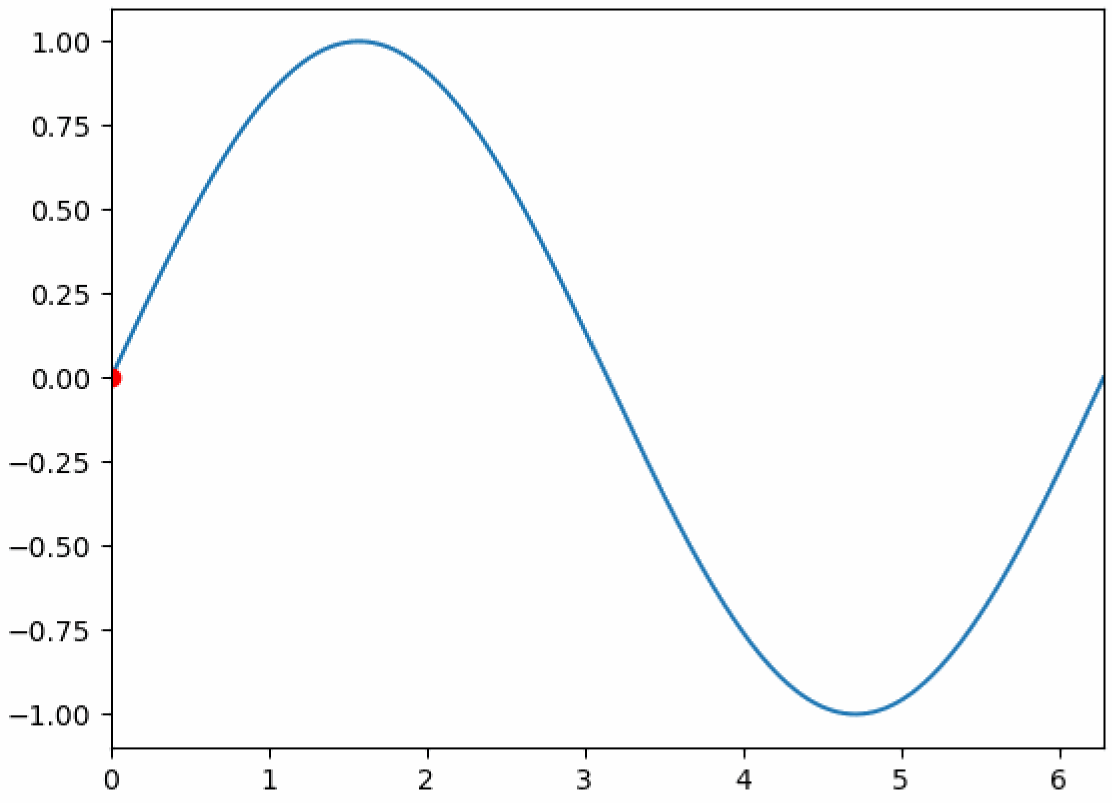
sf sample



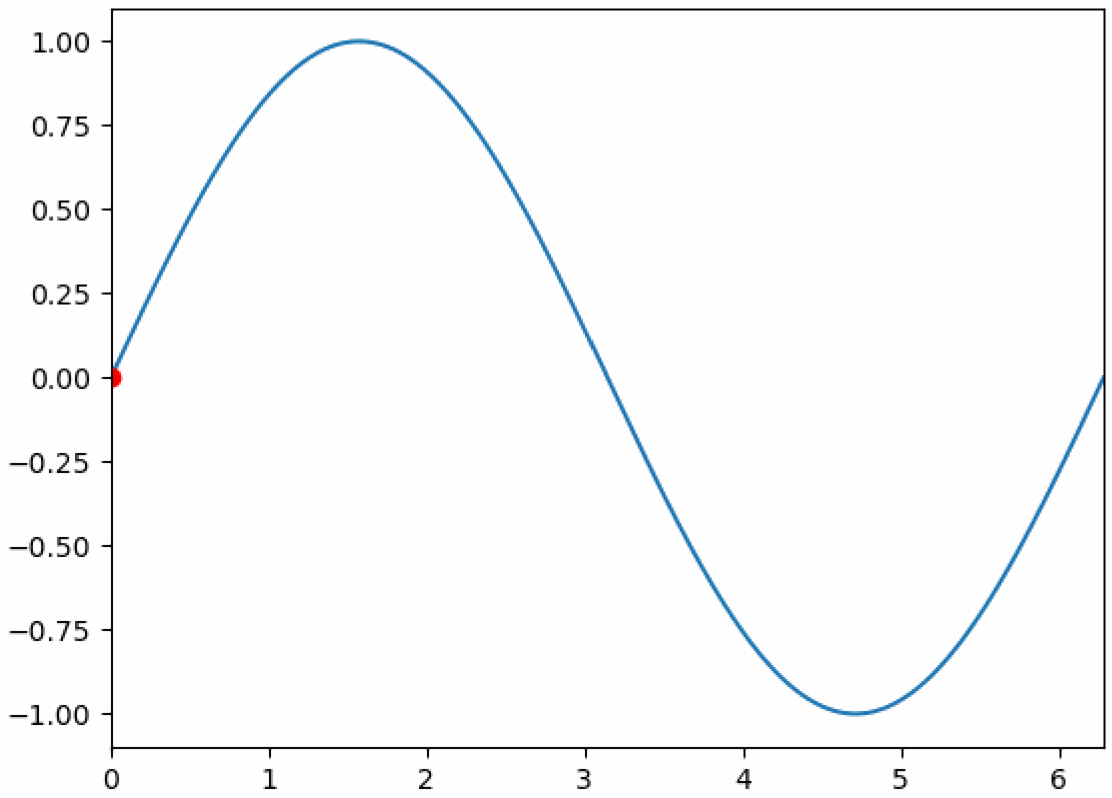
Skip to main content



Skip to main content



Skip to main content



```
import os
x=os.getcwd()
os.listdir(os.getcwd())
print(f"{os.getcwd()=}")
print(f"{x=}")
print(f"{os.listdir(x)=}")
```

```
os.getcwd()='/Users/ngcchk/Documents/GitHub/gpd2-win-unity1/ipadred-rain/imgno_book1/im
x='/Users/ngcchk/Documents/GitHub/gpd2-win-unity1/ipadred-rain/imgno_book1/imgnobk9'
os.listdir(x)=['JB_logo.png', 'test-Gif-ok2.gif', '.DS_Store', 'media copy', 'requireme
```

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```
import platform
print(f"{platform.system()=}")
# may need in the future to handle os difference
# but iPadOS and MacOS all report the same thing!!!
# not sure about ultimate target jypyter notebook 2b test
print(f"{platform.release()=}")
print(f"{platform.version()=}")

# ipad same as MacOS it seems though ... !!!
'''
platform.system()='Darwin'
platform.release()='22.6.0'
platform.version()='Darwin Kernel Version 22.6.0: Wed Jun 28 20:51:42 PDT 2023; root:xn
'''
```

```
platform.system()='Darwin'
platform.release()='22.6.0'
platform.version()='Darwin Kernel Version 22.6.0: Wed Jul  5 22:22:52 PDT 2023; root:xn
```

```
"\nplatform.system()='Darwin'\nplatform.release()='22.6.0'\nplatform.version()='Darwin
```

MacB9-Animate

1. Less is More Thinking

```
Thinking in Less Important Topics
```

May be just Frozen, Star Wars, Digital Currency ...

DB7-sync

Skip to main content

```
# 581.4 +\
# 96 +\

total = 123.2 +\
148.4 +\
63.6 +\
70.3 +\
379.2 +\
0774.9 +\
225.6 +\
39.2 +\
0103.6 +\
163.1 +\
318.5 +\
148 +\
20.2 +\
379.4 +\
94.1 +\
189.5 +\
332.8 +\
181.5 +\
489 +\
85.4 +\
99.7 +\
792 +\
172.7 +\
178.3 +\
0

print(total)
```

```
5572.2
```

test-Gif-ok

Gif sample

mainly from matplotlib ...

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```
# https://stackoverflow.com/questions/56423221/saving-animated-matplotlib-chart-to-gif
import os
import numpy as np
import matplotlib.pyplot as plt
import matplotlib.animation as animation
from matplotlib import rcParams

#%matplotlib qt
#%matplotlib tk
#%matplotlib

# configure full path for ImageMagick
# seems to work in iOS and macOS !!!

#rcParams['animation.convert_path'] = r'/usr/bin/convert'

TWOPI = 2*np.pi

fig, ax = plt.subplots()

t = np.arange(0.0, TWOPI, 0.001)
s = np.sin(t)
l = plt.plot(t, s)

ax = plt.axis([0,TWOPI,-1.1,1.1])

redDot, = plt.plot([0], [np.sin(0)], 'ro')

def animate(i):
    '''
/var/folders/_y/zx724y_158bf6f_4nxr4dm540000gn/T/ipykernel_72553/3641039220.py:24: Matp
  redDot.set_data(i, np.sin(i))
/var/folders/_y/zx724y_158bf6f_4nxr4dm540000gn/T/ipykernel_72553/3641039220.py:24: Matp
  redDot.set_data(i, np.sin(i))
    '''
    redDot.set_data(i, np.sin(i)) # seems later would not support this
    return redDot,

# create animation using the animate() function with no repeat
myAnimation = animation.FuncAnimation(fig, animate, frames=np.arange(0.0, TWOPI, 0.03),
                                      interval=100, blit=True, repeat=False)
# 0.01 quit slow
# 0.05
# save animation at 30 frames per second
#myAnimation.save('myAnimation.gif', writer='imagemagick', fps=30)

#plt.rcParams["figure.figsize"] = [7.50, 3.50]
#plt.rcParams["figure.autolayout"] = True

#dir_name = "C:/Windows/Temp/"
#dir_name = "image"

#plt.rcParams["savefig.directory"] = os.chdir(os.path.dirname(dir_name))
```

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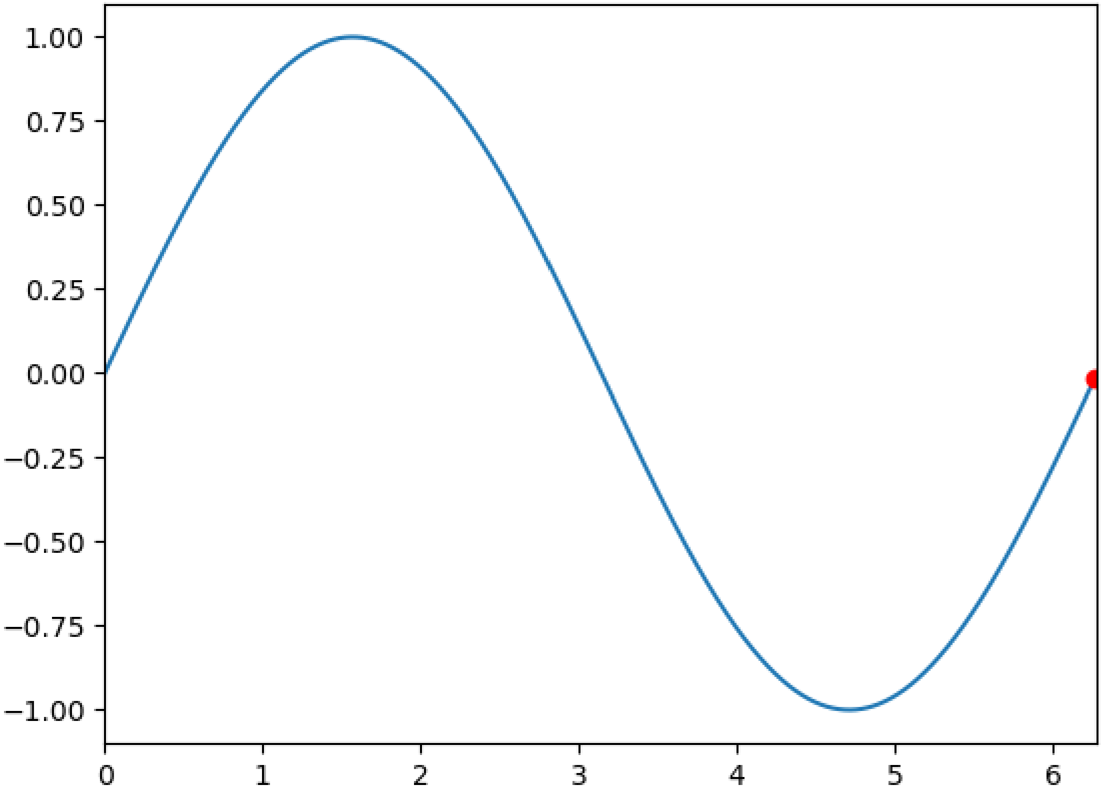
```
myAnimation.save('test-Gif-ok2.gif', writer='pillow', fps=30)
# seems default

plt.show()
```

```
/var/folders/33/krstvgns2rncl74r18tkv6_80000gn/T/ipykernel_32027/2052094205.py:36: Matp
  redDot.set_data(i, np.sin(i)) # seems later would not support this
/var/folders/33/krstvgns2rncl74r18tkv6_80000gn/T/ipykernel_32027/2052094205.py:36: Matp
  redDot.set_data(i, np.sin(i)) # seems later would not support this
```

```
/var/folders/33/krstvgns2rncl74r18tkv6_80000gn/T/ipykernel_32027/2052094205.py:36: Matp
  redDot.set_data(i, np.sin(i)) # seems later would not support this
```



```
# in code cell

import matplotlib.pyplot as plt

import matplotlib.image as mpimg

imgi2 = mpimg.imread("img/test-Gif-ok2.gif")
img2  = mpimg.imread("test-Gif-ok2.gif")

plt.imshow(imgi2) # but no animation
plt.imshow(img2) # but no animation
```

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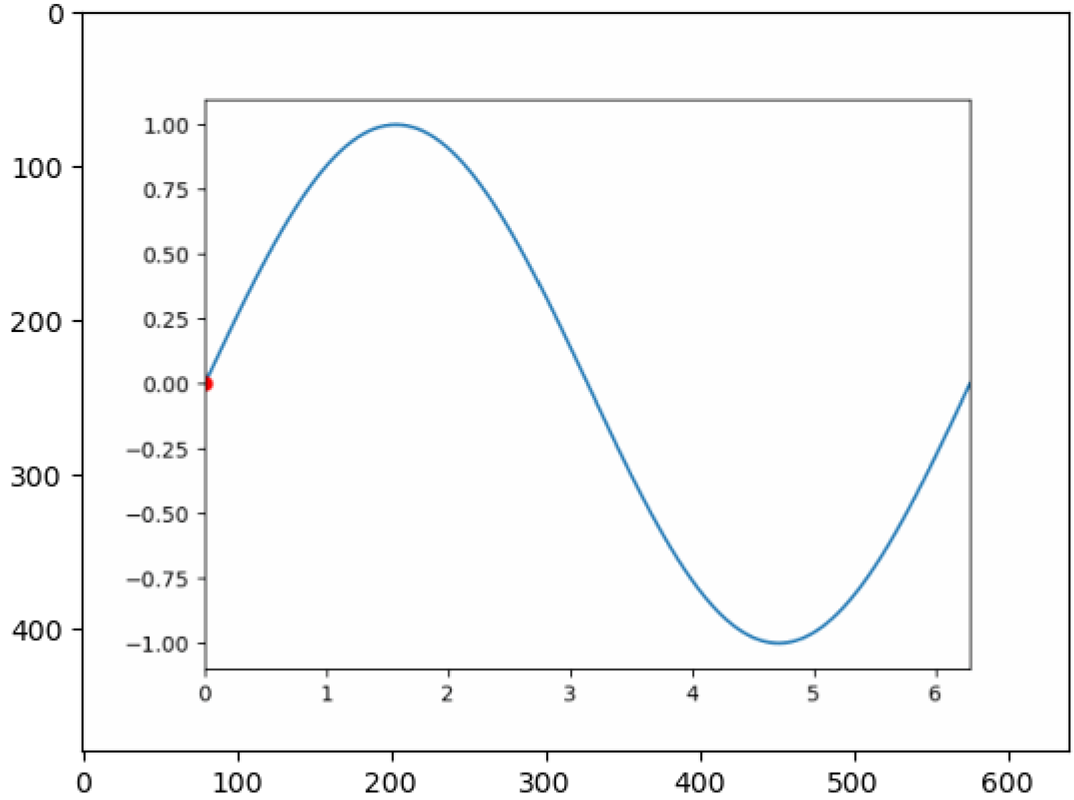
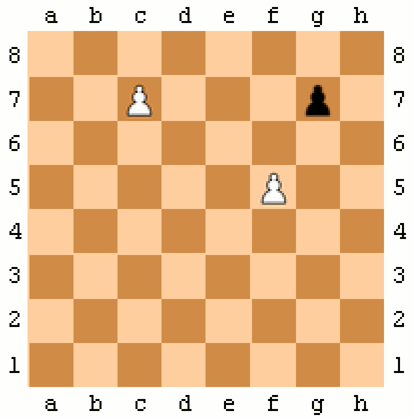
```
<matplotlib.image.AxesImage at 0x1064114d0>
```



```
## set working directory
```

in markdown one can try this:

[sf sample]



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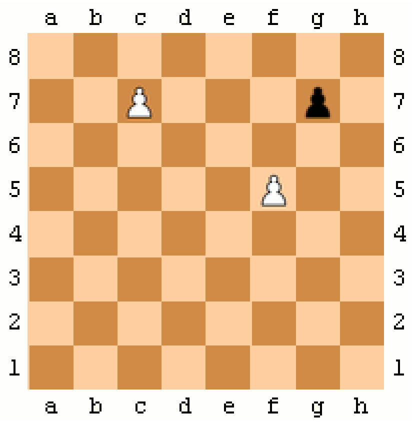
`

```
![SegmentLocal](/Users/username/some-folder/191px-Seven_segment_display-animated.gif "s
![SegmentLocal]("img/Gif-ok.gif" "segment")
[SegmentLocal]("img/Gif-ok.gif" "segment")

 ![SegmentLocal](/private/var/mobile/Containers/Data/Application/2E20887D-C1B2-42E5-B5D

[SegmentLocal](img/test-Gif-ok.gif "segment")

[SegmentLocal]("test-Gif-ok.gif" "segment")
```

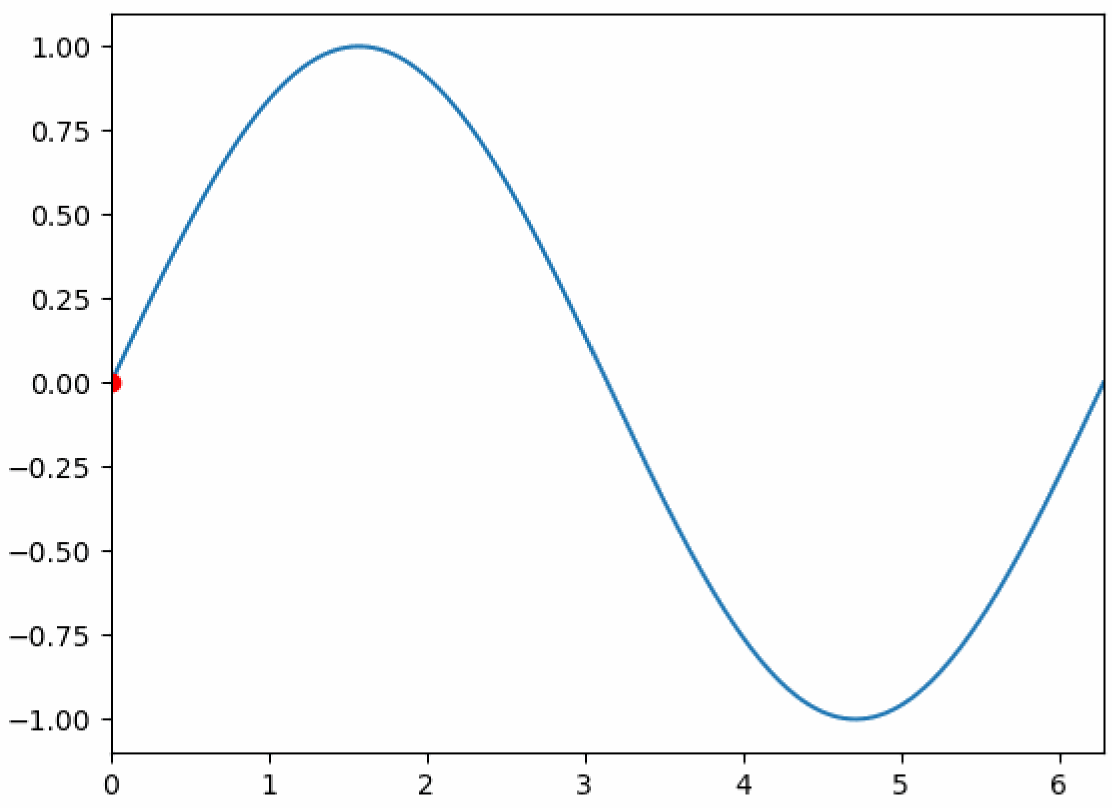
`

work

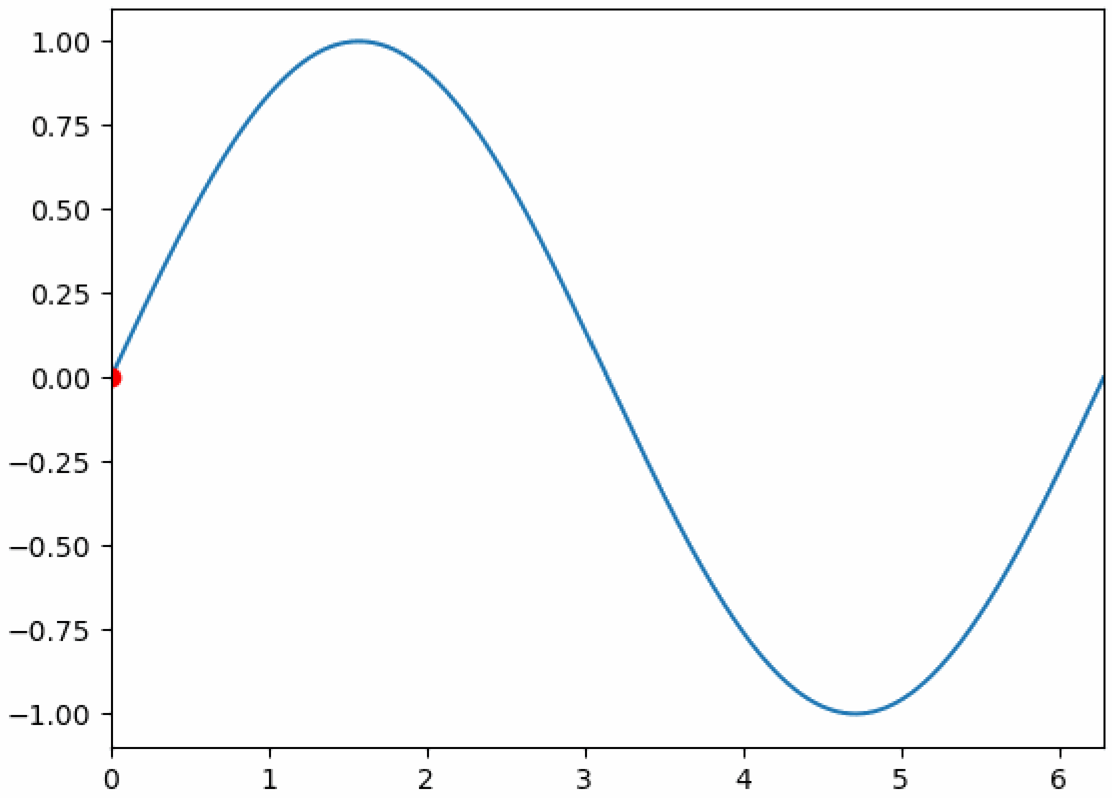
sf sample



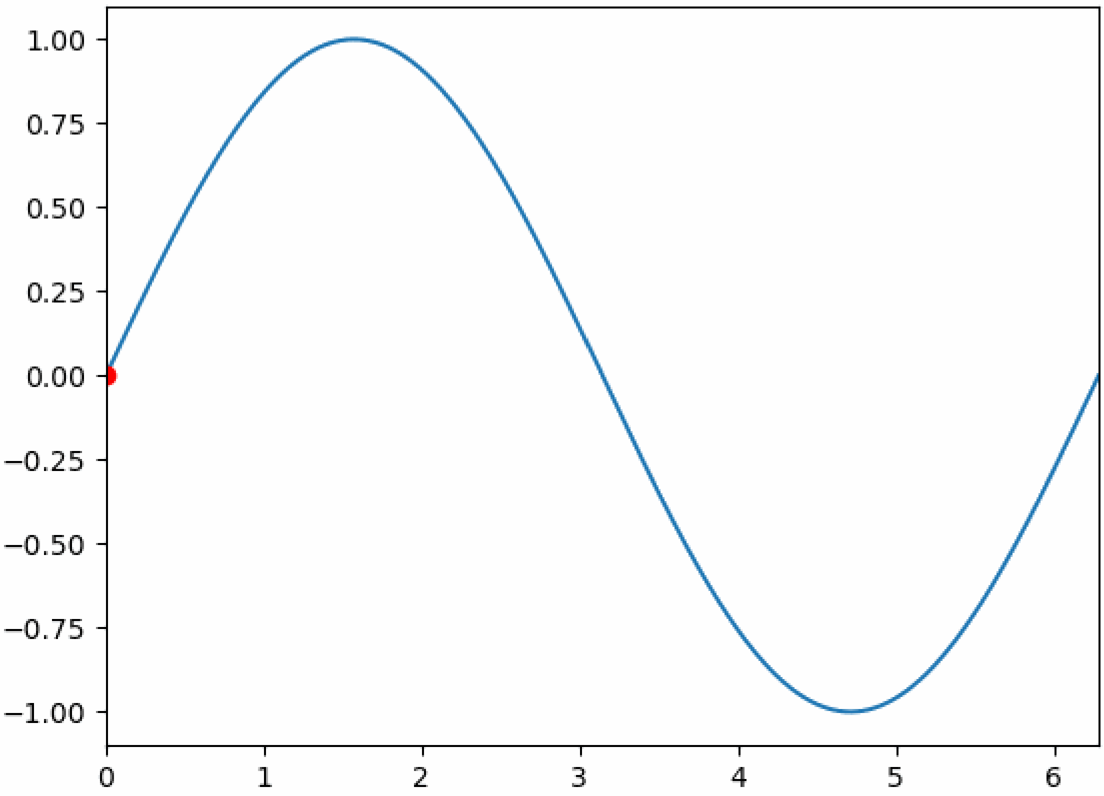
Skip to main content



Skip to main content



Skip to main content



```python
import os
x=os.getcwd()
os.listdir(os.getcwd())
print(f"{os.getcwd()=}")
print(f"{x=}")
print(f"{os.listdir(x)=}")
```

```
os.getcwd()='/Users/ngcchk/Documents/GitHub/gpd2-win-unity1/ipadred-rain/imgno_book1/im
x='/Users/ngcchk/Documents/GitHub/gpd2-win-unity1/ipadred-rain/imgno_book1/imgnobk9'
os.listdir(x)=['JB_logo.png', 'test-Gif-ok2.gif', '.DS_Store', 'media copy', 'requireme
```

Skip to main content

```
import platform
print(f"{platform.system()=}")
print(f"{platform.release()=}")
print(f"{platform.version()=}")

# ipad
'''
platform.system()='Darwin'
platform.release()='22.6.0'
platform.version()='Darwin Kernel Version 22.6.0: Wed Jun 28 20:51:42 PDT 2023; root:xn
'''
```

```
platform.system()='Darwin'
platform.release()='22.6.0'
platform.version()='Darwin Kernel Version 22.6.0: Wed Jul  5 22:22:52 PDT 2023; root:xn
```

```
"\nplatform.system()='Darwin'\nplatform.release()='22.6.0'\nplatform.version()='Darwin
```

test-iter

```
import  os
os.getcwd()
# os.chdir("")
'''
# ios
'/private/var/mobile/Containers/Shared/AppGroup/A224EFAB-AEB3-4B3B-A2A9-EE4282ED0D4A/Fi
'''
```

```
"\n# ios\n'/private/var/mobile/Containers/Shared/AppGroup/A224EFAB-AEB3-4B3B-A2A9-EE428
```

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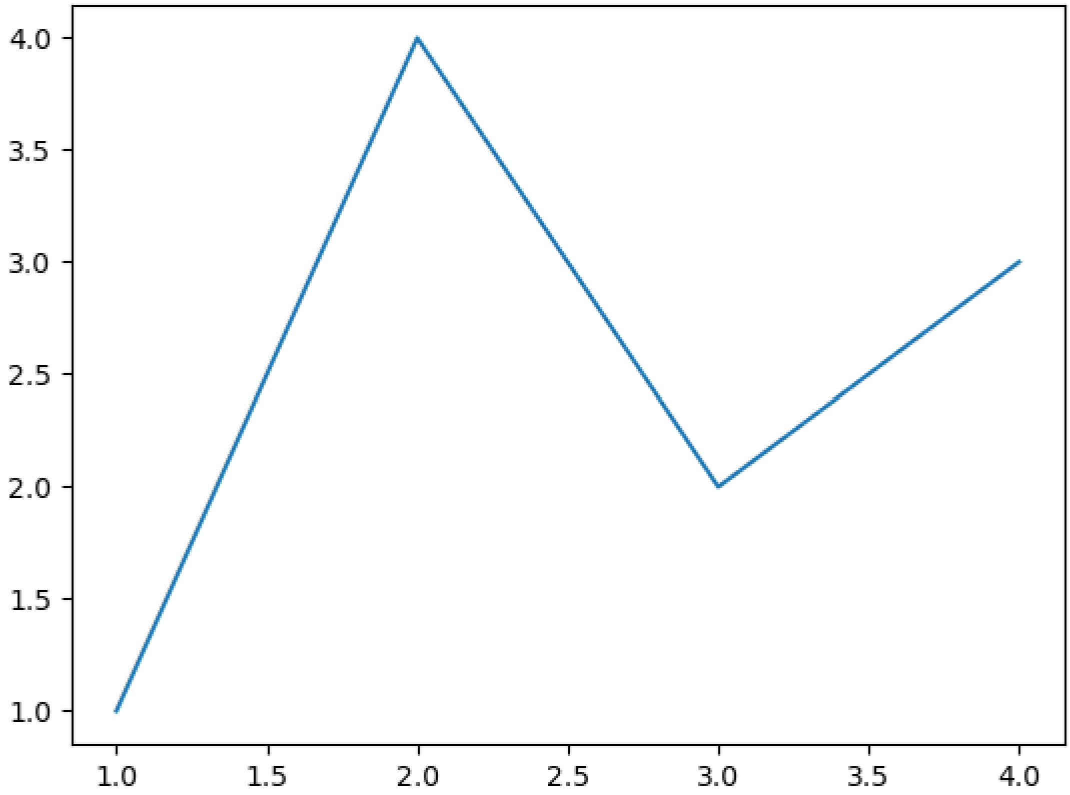
```
# https://matplotlib.org/stable/tutorials/introductory/usage.html#what-is-a-backend
import matplotlib
import matplotlib.pyplot as plt
# matplotlib.use('Agg') #'MacOS' ??
import pylab
#from pylab import *
import calendar
import numpy as np

fig, ax = plt.subplots()  # Create a figure containing a single axes.
ax.plot([1, 2, 3, 4], [1, 4, 2, 3])  # Plot some data on the axes.

#plt.show()
```

```
[<matplotlib.lines.Line2D at 0x11c323b90>]
```



```
fig = plt.figure()  # an empty figure with no Axes
fig, ax = plt.subplots()  # a figure with a single Axes
fig, axs = plt.subplots(2, 2)  # a figure with a 2x2 grid of Axes
# a figure with one axes on the left, and two on the right:
fig, axs = plt.subplot_mosaic([['left', 'right_top'],
                               ['left', 'right_bottom']])

#plt.show()
```

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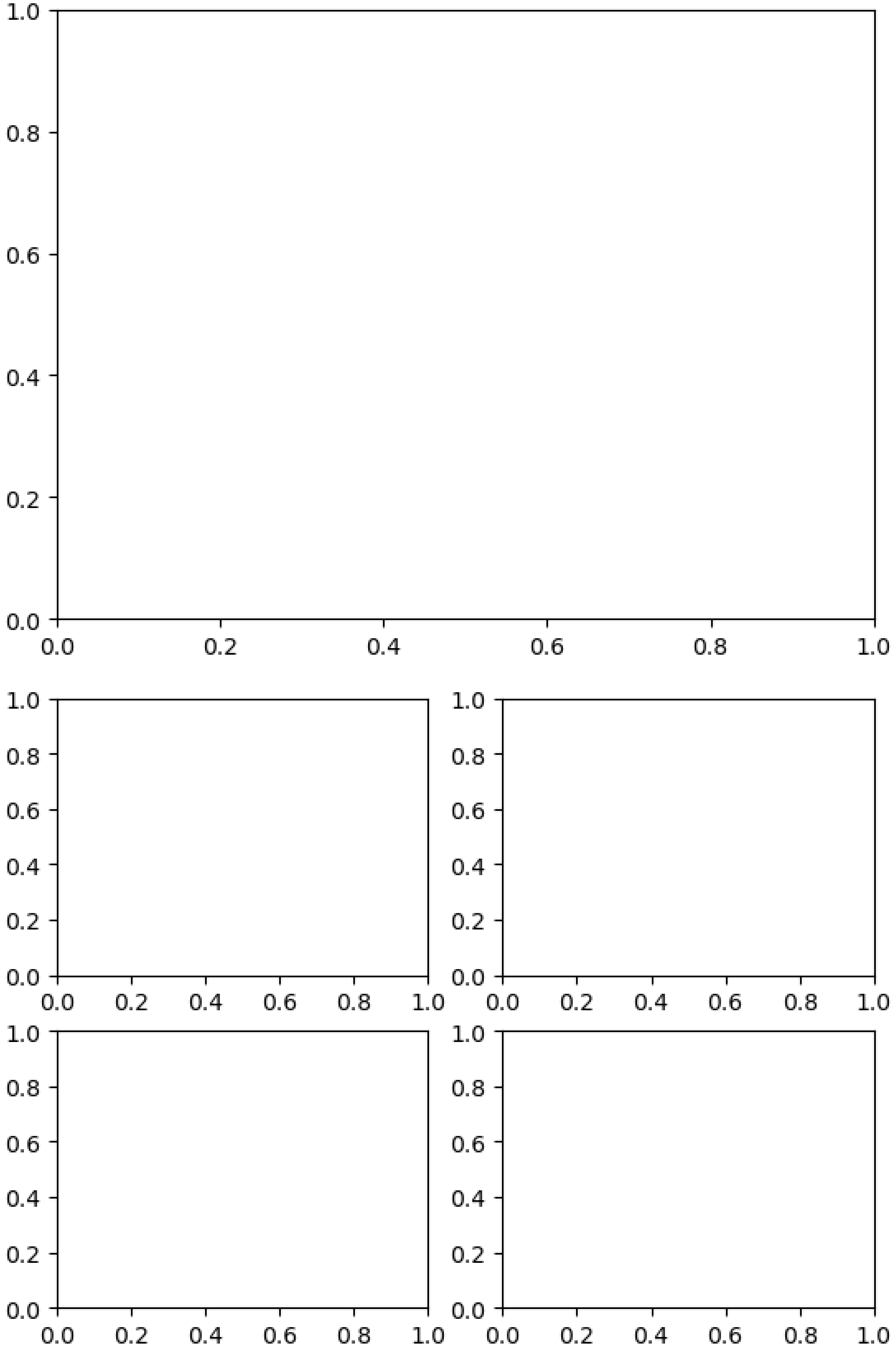
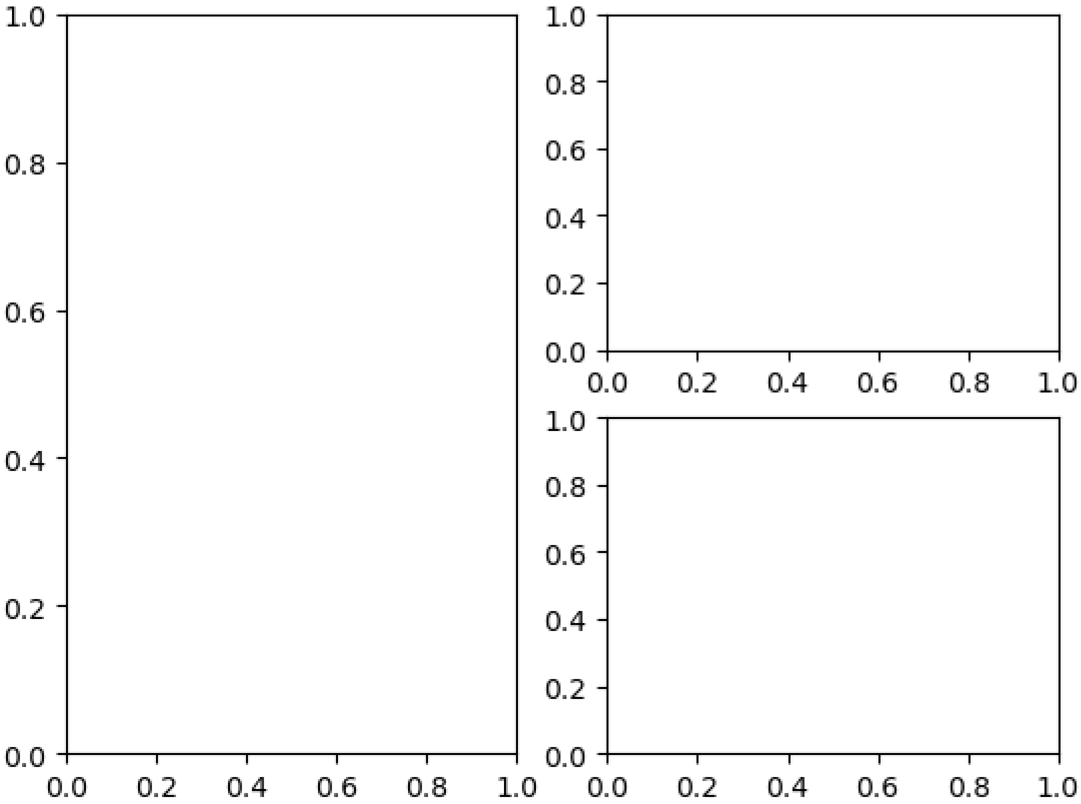
```
<Figure size 640x480 with 0 Axes>
```



Skip to main content



```
b = np.matrix([[1, 2], [3, 4]])
print(b)
b_asarray = np.asarray(b)
print(b_asarray)

# seems implicitly has plots
```

```
[[1 2]
 [3 4]]
[[1 2]
 [3 4]]
```

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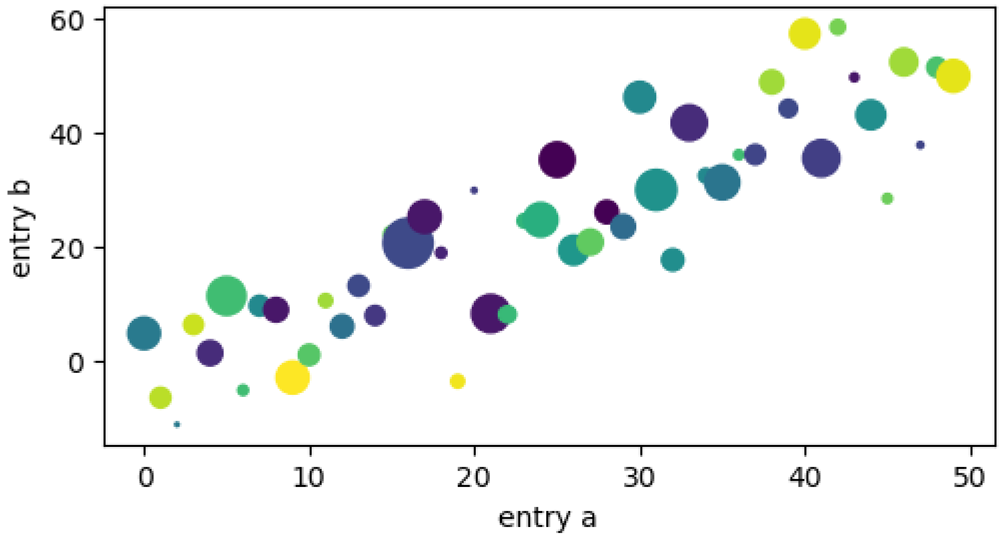
```
np.random.seed(19680801)  # seed the random number generator.
data = {'a': np.arange(50),
        'c': np.random.randint(0, 50, 50),
        'd': np.random.randn(50)}
data['b'] = data['a'] + 10 * np.random.randn(50)
data['d'] = np.abs(data['d']) * 100
#print(data)
print(data['a'])
print(data['b'])
#print(f'{data['a']}') no work
#,\n,{b},\n,{c},\n,{d},\n')

fig, ax = plt.subplots(figsize=(5, 2.7), layout='constrained')
ax.scatter('a', 'b', c='c', s='d', data=data)
ax.set_xlabel('entry a')
ax.set_ylabel('entry b')
```

```
[ 0  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47
 48 49]
[  4.8018808   -6.4972666  -11.2077656    6.322316     1.33391659
  11.36202025  -5.18315173   9.64545151   8.93059413  -2.9619809
   1.010722    10.5460328    6.02832418  13.15619153   7.92816087
  22.2140083   20.64277678  25.26559419  18.93012033  -3.62283088
  29.90723646   8.2618424    8.1226306   24.55220778  24.73672481
  35.29148044  19.39618445  20.81129384  26.1046295   23.53964929
  46.2580496   29.97454235  17.69996036  41.7538301   32.48260765
  31.30030868  36.13983623  36.18332016  48.92477345  44.27782523
  57.41677485  35.53675523  58.57367953  49.73629965  43.15151999
  28.47595654  52.43563731  37.8567097   51.49878342  49.98087623]
```

```
Text(0, 0.5, 'entry b')
```



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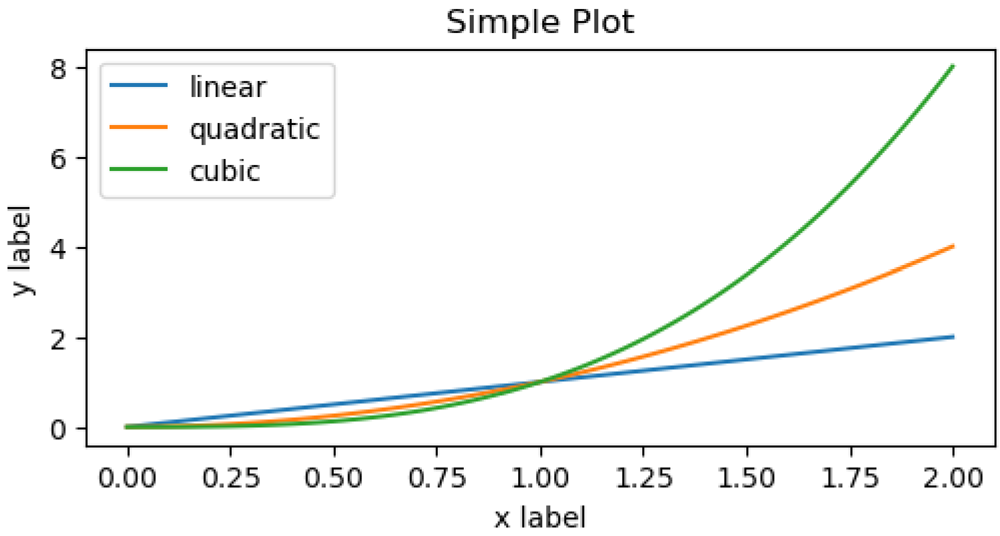
```
x = np.linspace(0, 2, 100)  # Sample data.

# Note that even in the OO-style, we use `.pyplot.figure` to create the Figure.
fig, ax = plt.subplots(figsize=(5, 2.7), layout='constrained')
ax.plot(x, x, label='linear')  # Plot some data on the axes.
ax.plot(x, x**2, label='quadratic')  # Plot more data on the axes...
ax.plot(x, x**3, label='cubic')  # ... and some more.
ax.set_xlabel('x label')  # Add an x-label to the axes.
ax.set_ylabel('y label')  # Add a y-label to the axes.
ax.set_title("Simple Plot")  # Add a title to the axes.
ax.legend()  # Add a legend.
```

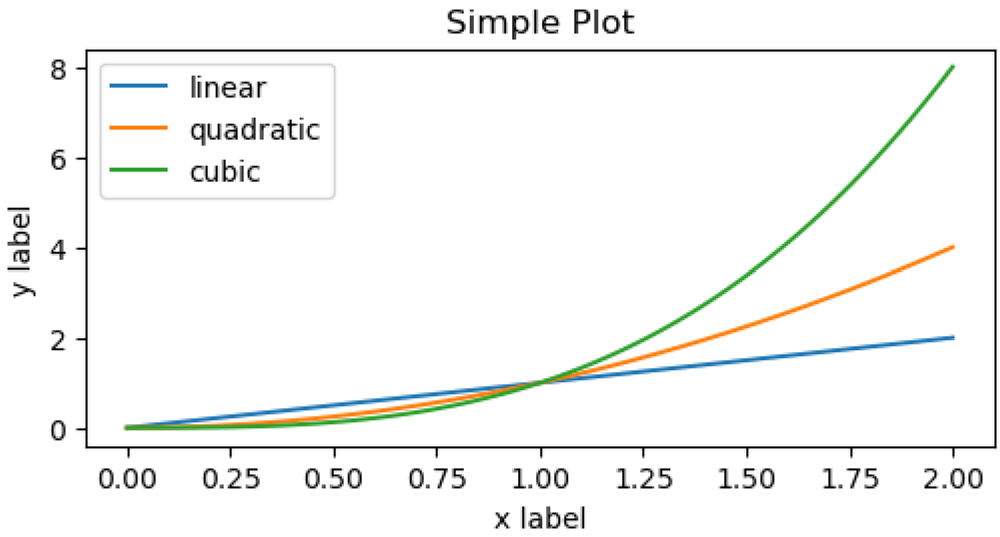
```
<matplotlib.legend.Legend at 0x11ce44cd0>
```



```
x = np.linspace(0, 2, 100)  # Sample data.

plt.figure(figsize=(5, 2.7), layout='constrained')
plt.plot(x, x, label='linear')  # Plot some data on the (implicit) axes.
plt.plot(x, x**2, label='quadratic')  # etc.
plt.plot(x, x**3, label='cubic')
plt.xlabel('x label')
plt.ylabel('y label')
plt.title("Simple Plot")
plt.legend()
```

Skip to main content

```
<matplotlib.legend.Legend at 0x11cedd610>
```



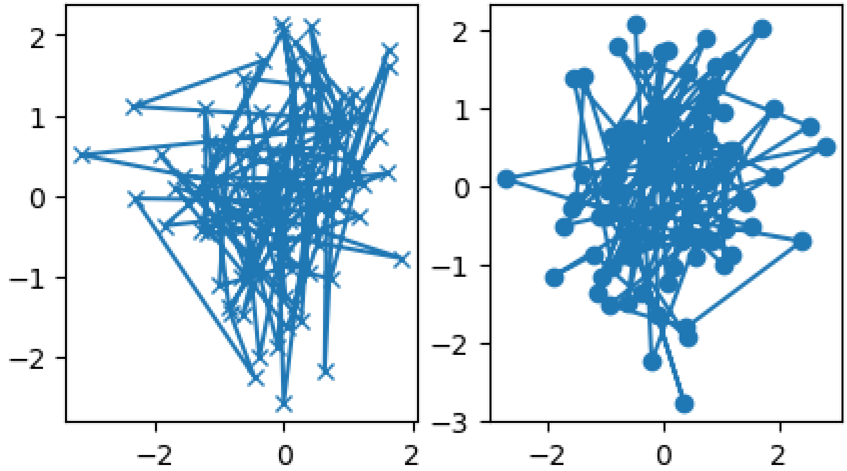
use embedded

https://matplotlib.org/stable/gallery/user_interfaces/index.html#user-interfaces

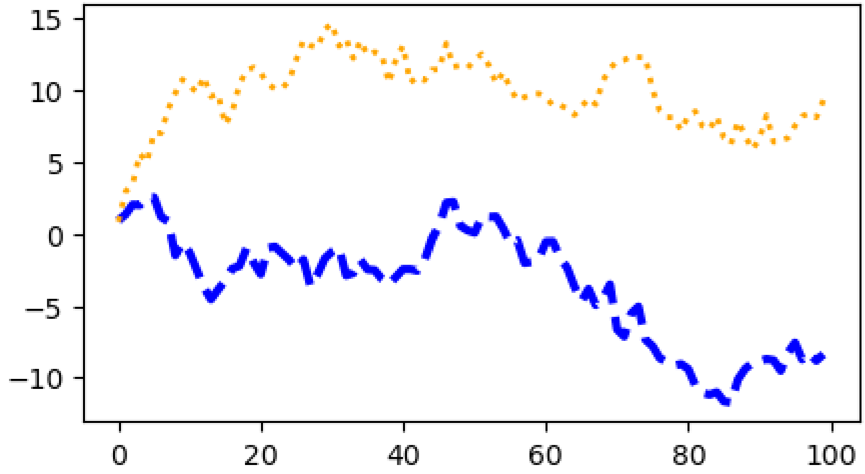
```python
def my_plotter(ax, data1, data2, param_dict):
    """
    A helper function to make a graph.
    """
    out = ax.plot(data1, data2, **param_dict)
    return out

data1, data2, data3, data4 = np.random.randn(4, 100)  # make 4 random data sets
fig, (ax1, ax2) = plt.subplots(1, 2, figsize=(5, 2.7))
my_plotter(ax1, data1, data2, {'marker': 'x'})
my_plotter(ax2, data3, data4, {'marker': 'o'})
```

Skip to main content

```
[<matplotlib.lines.Line2D at 0x11cf96bd0>]
```



```
fig, ax = plt.subplots(figsize=(5, 2.7))
x = np.arange(len(data1))
ax.plot(x, np.cumsum(data1), color='blue', linewidth=3, linestyle='--')
l, = ax.plot(x, np.cumsum(data2), color='orange', linewidth=2)
l.set_linestyle(':')
```



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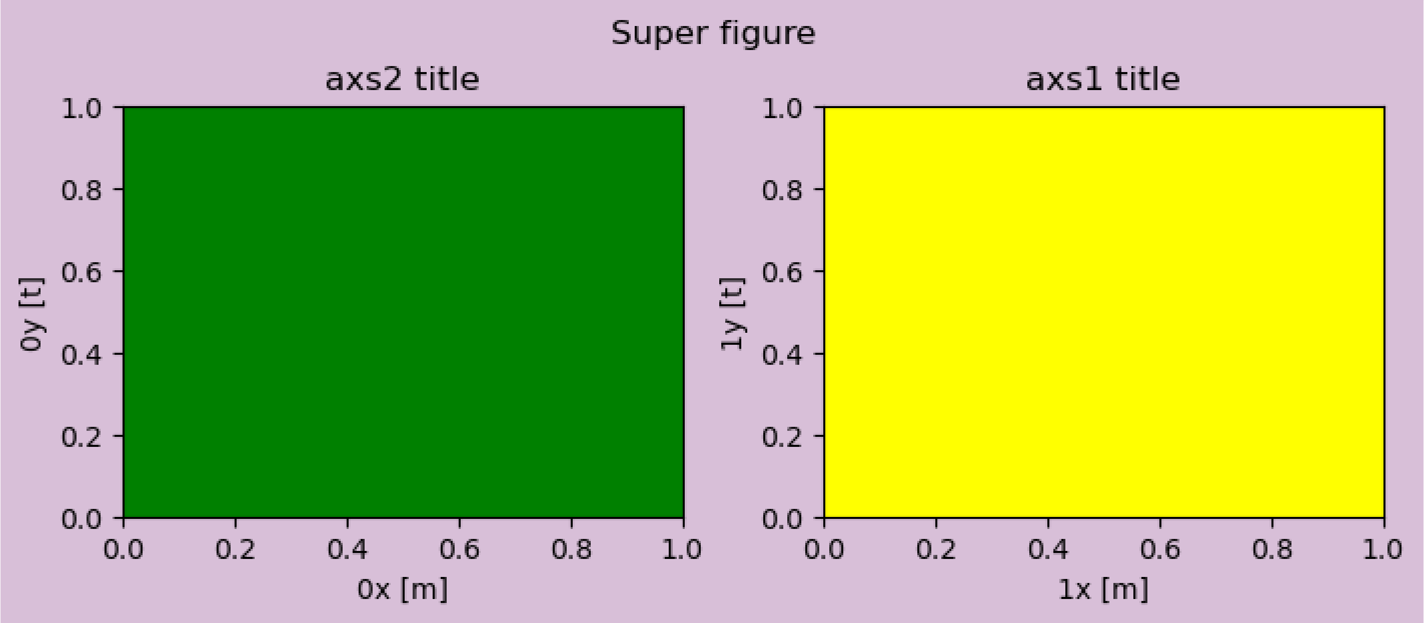
```
# fig, axs = plt.subplots(2, 2, figsize=(4, 3), layout='constrained')

fig, axs = plt.subplots(1, 2, figsize=( 7, 3), layout='constrained')

fig.set_facecolor('thistle')
fig.suptitle('Super figure')

# axs = fig.subplots(2, 1, sharex=True)
# axs = fig.subplots(2, 1, sharey=True)

# axs = fig.subplots(2, 1, sharex=True)

axs[1].set_xlabel('1x [m]')
axs[1].set_ylabel('1y [t]')
axs[1].set_facecolor('yellow')
axs[1].set_title('axs1 title')

axs[0].set_xlabel('0x [m]')
axs[0].set_ylabel('0y [t]')
axs[0].set_facecolor('green')
axs[0].set_title('axs2 title')
```

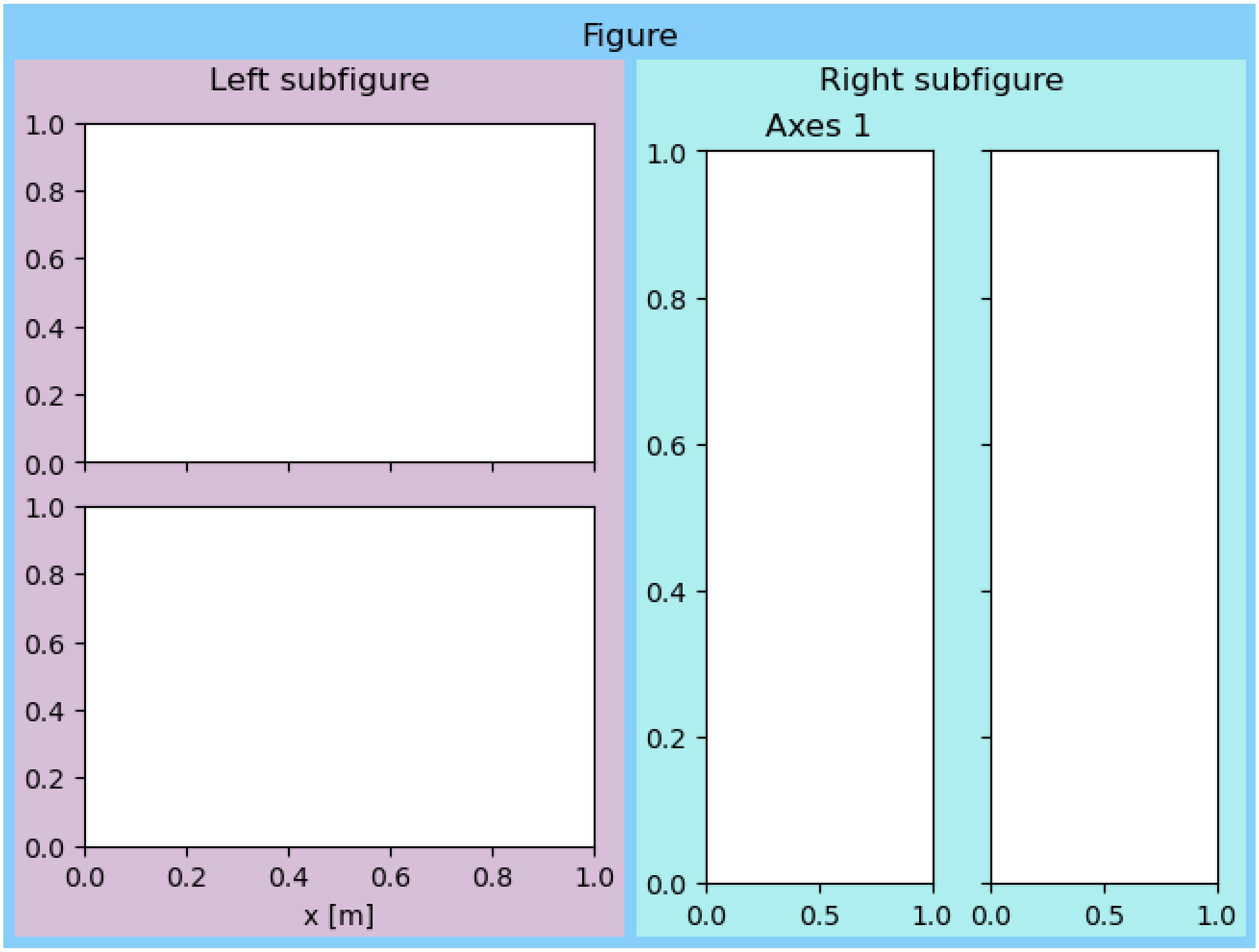
```
Text(0.5, 1.0, 'axs2 title')
```



Skip to main content

```python
fig = plt.figure(layout='constrained', facecolor='lightskyblue')
fig.suptitle('Figure')
figL, figR = fig.subfigures(1, 2)
figL.set_facecolor('thistle')
axL = figL.subplots(2, 1, sharex=True)
axL[1].set_xlabel('x [m]')
figL.suptitle('Left subfigure')
figR.set_facecolor('paleturquoise')
axR = figR.subplots(1, 2, sharey=True)
axR[0].set_title('Axes 1')
figR.suptitle('Right subfigure')
```

```
Text(0.5, 0.98, 'Right subfigure')
```



Skip to main content

```
# https://gist.github.com/matthewfeickert/84245837f09673b2e7afea929c016904
# non inter and aggg

import matplotlib
import matplotlib.pyplot as plt
import numpy as np
print("somethin")

#if __name__ == "__main__":
print(f"Interactive mode: {matplotlib.is_interactive()}")
# Agg is non-interactive and will not even import the GUI frameworks
# c.f.
# https://matplotlib.org/stable/tutorials/introductory/usage.html#what-is-a-backend
# c.f. https://twitter.com/tacaswell/status/1377122080664166408
matplotlib.use("agg")
print(f"matplotlib backend: {matplotlib.rcParams['backend']}")

x = np.linspace(0, 10, 1000)
y = np.sin(x)

fig, ax = plt.subplots()
ax.plot(x, y)
fig.savefig("nongui_backend.png")



#fig.show()  # Errors as no GUI possible

#plt.show()
```

```
somethin
Interactive mode: True
matplotlib backend: agg
```

Some iterable

An ITERABLE is:

1. anything that can be looped over (i.e. you can loop over a string or file) or
2. anything that can appear on the right-side of a for-loop: for x in iterable: ... or
3. anything you can call with iter() that will return an ITERATOR: iter(obj) or
4. an object that defines **iter** that returns a fresh ITERATOR, or it may have a **getitem** method suitable

Skip to main content

An ITERATOR is an object:

1. with state that remembers where it is during iteration,
2. with a **next** method that: returns the next value in the iteration updates the state to point at the next value signals when it is done by raising StopIteration and that is self-iterable (meaning that it has an **iter** method that returns self).
3. Notes: The **next** method in Python 3 is spelt next in Python 2, and The builtin function next() calls that method on the object passed to it.

   For example:

```
s = 'cat'      # s is an ITERABLE
                   # s is a str object that is immutable
                   # s has no state
                   # s has a __getitem__() method

t = iter(s)    # t is an ITERATOR
                   # t has state (it starts by pointing at the "c"
                   # t has a next() method and an __iter__() method

next(t)        # the next() function returns the next value and advances the state 'c'
next(t)        # the next() function returns the next value and advances
# 'a'
next(t)        # the next() function returns the next value and advances
# 't'

iter(t) is t   # the iterator is self-iterable

#next(t)        # next() raises StopIteration to signal that iteration is complete
#Traceback (most recent call last):
#...
#StopIteration
```

```
True
```

Skip to main content

```python
class Counter:
    def __init__(self, low, high):
        self.current = low - 1
        self.high = high

    def __iter__(self):
        return self

    def __next__(self): # Python 2: def next(self)
        self.current += 1
        if self.current < self.high:
            return self.current
        raise StopIteration


for c in Counter(3, 9):
    print(c)
```

```
3
4
5
6
7
8
```

Skip to main content

```
# https://stackoverflow.com/questions/7871338/creating-bar-charts-in-python

import matplotlib
matplotlib.use('Agg')
import pylab
#from pylab import *
import calendar

def webshow(img):
    savefig(img,dpi=500)
    print( 'Content-Type: text/html\n')
    print('<img width="800" height="400" src="'+img+'" />')

sorted_list = ((1, 2),( 3,4 ), (5, 6) , (7, 8))
#np.linspace(0, 10, 1000)


genres = []
n = 0
for c in sorted_list:
    genres.append(sorted_list[n][0])
    n += 1

grosses = []
a = 0
for c in sorted_list:
    grosses.append(sorted_list[a][1])
    a += 1

pylab.clf()
#bar(arange(len(grosses)),grosses)
#xticks( arange(len(genres)),genres, rotation=80)
#webshow("barchart.png")


import numpy as np
import numpy as np
import matplotlib.pyplot as plt
import matplotlib.animation as animation
from matplotlib import rcParams



fig = plt.figure()
fig.subplots_adjust(bottom=0.2)          # Remark 1
ax = fig.add_subplot(111)
ax.bar(np.arange(len(grosses)), grosses)
ax.ticklabel_format(style='plain')       # Remark 2
ax.set_xticks(np.arange(len(genres)))
ax.set_xticklabels(genres, rotation=80)

TWOPI = 2*np.pi
```

Skip to main content

```
def animate(i):
    redDot.set_data(i, np.sin(i))
    return redDot,

myAnimation = animation.FuncAnimation(fig, animate, frames=np.arange(0.0, TWOPI, 0.03),


myAnimation.save('iter-ok1.gif', writer='pillow', fps=30)


#savefig('barchart.png', dpi=500)
```

```
/var/folders/33/krstvgns2rncl74r18tkv6_80000gn/T/ipykernel_32020/3627587708.py:58: Matp
  redDot.set_data(i, np.sin(i))
/var/folders/33/krstvgns2rncl74r18tkv6_80000gn/T/ipykernel_32020/3627587708.py:58: Matp
  redDot.set_data(i, np.sin(i))
```

```
from collections.abc import Iterable

li = [1,2,3,4]
var1 = 16

print(isinstance(li, Iterable))
print(isinstance(var1, Iterable))
```

```
True
False
```

Skip to main content

```
'''
# no pyecharts ...

from pyecharts.charts import Bar
from pyecharts import options as opts

# Define data
x_data = ['A', 'B', 'C', 'D', 'E']
y_data = [10, 20, 30, 40, 50]

# Create a basic bar chart
bar = Bar()
bar.add_xaxis(x_data)
bar.add_yaxis("", y_data)

# Set chart options
bar.set_global_opts(title_opts=opts.TitleOpts(title="Basic Bar Chart"))

# Render chart
bar.render("basic_bar_chart.html")
'''
```

```
'\n# no pyecharts ...\n\nfrom pyecharts.charts import Bar\nfrom pyecharts import option
```

```
'''
# not able to add bar yet

import matplotlib
import matplotlib.pyplot as plt
import numpy as np
import matplotlib.animation as animation

x = np.linspace(0, 10, 1000)
def update_figure():
    y = np.sin(x)
    return


figure, ax = plt.subplots()

anim = animation.FuncAnimation(figure, func=update_figure, fargs=(bar, iteration), fram



f = r"c://Users/xx/Desktop/animation.gif"
writergif = animation.PillowWriter(fps=30)
anim.save(f, writer=writergif)
'''
```

Skip to main content

```
'\n# not able to add bar yet\n\nimport matplotlib\nimport matplotlib.pyplot as plt\nimp
```

```
mytuple = ("apple", "banana", "cherry")
myit = iter(mytuple)

print(next(myit))
print(next(myit))
print(next(myit))
```

```
apple
banana
cherry
```

Skip to main content

```
'''
# the raise StopIteration can cause some issues
class MyNumbers:
  def __iter__(self):
    self.a = 1
    return self

  def __next__(self):
    if self.a <= 120:
      x = self.a
      self.a += 1
      return x
    else:
      raise StopIteration

myclass = MyNumbers()
myiter = iter(myclass)

#for x in myiter:
#  print(x,",",end="")
# https://holypython.com/how-to-create-matplotlib-animations-the-ultimate-guide/




import random
import matplotlib
import matplotlib.pyplot as plt
from matplotlib.animation import FuncAnimation

fig = plt.figure(figsize=(15,15))


x,y = [], []
index= iter(myclass)
# MyContainer(1, "two", 3, 4.0)
#(1, 2, 3, 4, 1, 4, 1)
#()tuple # [] list]# np.arange (0.0, TWOPI, 0.1) #count()
def animate(i):
    x.append(next(index))
    y.append(random.randint(2,20))
    plt.style.use("ggplot")
    plt.plot(x,y)

ani = FuncAnimation(fig, animate, interval=300)
ani.save('ani.gif', writer='pillow', fps=30)
plt.show()
'''
```

```
'\n# the raise StopIteration can cause some issues\nclass MyNumbers:\n  def __iter__(se
```

Skip to main content

```python
# https://stackoverflow.com/questions/56423221/saving-animated-matplotlib-chart-to-gif

import numpy as np
import matplotlib.pyplot as plt
import matplotlib.animation as animation
from matplotlib import rcParams

# configure full path for ImageMagick
rcParams['animation.convert_path'] = r'/usr/bin/convert'

TWOPI = 2*np.pi

fig, ax = plt.subplots()

t = np.arange(0.0, TWOPI, 0.001)
s = np.sin(t)
l = plt.plot(t, s)

ax = plt.axis([0,TWOPI,-1,1])

redDot, = plt.plot([0], [np.sin(0)], 'ro')

def animate(i):
    redDot.set_data(i, np.sin(i))
    return redDot,

# create animation using the animate() function with no repeat
myAnimation = animation.FuncAnimation(fig, animate, frames=np.arange(0.0, TWOPI, 0.1),
                                      interval=10, blit=True, repeat=False)

# save animation at 30 frames per second
#myAnimation.save('myAnimation.gif', writer='imagemagick', fps=30)

myAnimation.save('myAnimation.gif', writer='pillow', fps=30)
```

```
/var/folders/33/krstvgns2rncl74r18tkv6_80000gn/T/ipykernel_32020/25224506.py:24: Matplo
  redDot.set_data(i, np.sin(i))
/var/folders/33/krstvgns2rncl74r18tkv6_80000gn/T/ipykernel_32020/25224506.py:24: Matplo
  redDot.set_data(i, np.sin(i))
```

test-Juno-2

Random text now...

Moon is different as it involves not a ruler holding by moving observator. Instead we have a moving

Skip to main content

effectively the spaceclike sude actualky maintain the length calculation using euclidian geometry or it draw an arc of $\delta x_0 = \gamma x$

the point on the $\tilde{c}t$ line proper time dot follow hyperbola (as $satx = 0$ rotate against the curve $\tilde{s}^2 = (c\tilde{t})^2 - \tilde{x}^2$). but the point of $\tilde{x}$ at $\tilde{x}$ follow δx_0

test3

.. redirect-from:: /tutorials/introductory/animation_tutorial

Animations using Matplotlib

Based on its plotting functionality, Matplotlib also provides an interface to generate animations using the `~matplotlib.animation` module. An animation is a sequence of frames where each frame corresponds to a plot on a `~matplotlib.figure.Figure`. This tutorial covers a general guideline on how to create such animations and the different options available.

```
import matplotlib.pyplot as plt
import numpy as np

import matplotlib.animation as animation

# default nothing does not work here!!!
# %matplotlib
# %matplotlib qt
%matplotlib tk
```

Animation Classes

The animation process in Matplotlib can be thought of in 2 different ways:

- `~matplotlib.animation.FuncAnimation`: Generate data for first frame and then modify this data for each frame to create an animated plot.
- `~matplotlib.animation.ArtistAnimation`: Generate a list (iterable) of artists that will draw in each frame in the animation.

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`~matplotlib.animation.FuncAnimation` is more efficient in terms of speed and memory as it draws an artist once and then modifies it. On the other hand `~matplotlib.animation.ArtistAnimation` is flexible as it allows any iterable of artists to be animated in a sequence.

`FuncAnimation`

The `~matplotlib.animation.FuncAnimation` class allows us to create an animation by passing a function that iteratively modifies the data of a plot. This is achieved by using the *setter* methods on various `~matplotlib.artist.Artist` (examples: `~matplotlib.lines.Line2D`, `~matplotlib.collections.PathCollection`, etc.). A usual `~matplotlib.animation.FuncAnimation` object takes a `~matplotlib.figure.Figure` that we want to animate and a function *func* that modifies the data plotted on the figure. It uses the *frames* parameter to determine the length of the animation. The *interval* parameter is used to determine time in milliseconds between drawing of two frames. Animating using `.FuncAnimation` would usually follow the following structure:

- Plot the initial figure, including all the required artists. Save all the artists in variables so that they can be updated later on during the animation.
- Create an animation function that updates the data in each artist to generate the new frame at each function call.
- Create a `.FuncAnimation` object with the `.Figure` and the animation function, along with the keyword arguments that determine the animation properties.
- Use `.animation.Animation.save` or `.pyplot.show` to save or show the animation.

The update function uses the `set_*` function for different artists to modify the data. The following table shows a few plotting methods, the artist types they return and some methods that can be used to update them.

== ==============================
=========================== Plotting method Artist Set method
== ==============================
=========================== `.Axes.plot` `.lines.Line2D` `~.lines.Line2D.set_data`
`.Axes.scatter` `.collections.PathCollection`

`~.collections.\`

`PathCollection.set_offsets` `.Axes.imshow` `.image.AxesImage` `AxesImage.set_data`
`.Axes.annotate` `.text.Annotation`

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`~.Rectangle.set_bounds`, `~.Rectangle.set_height`, `~.Rectangle.set_width`, `~.Rectangle.set_x`, `~.Rectangle.set_y`, `~.Rectangle.set_xy` `.Axes.fill` `.patches.Polygon` `~.Polygon.set_xy` `.Axes.add_patch`(`.patches.Ellipse`) `.patches.Ellipse` `~.Ellipse.set_angle`, `~.Ellipse.set_center`, `~.Ellipse.set_height`, `~.Ellipse.set_width` ================================ ============================== ========================

Covering the set methods for all types of artists is beyond the scope of this tutorial but can be found in their respective documentations. An example of such update methods in use for `.Axes.scatter` and `.Axes.plot` is as follows.

```
fig, ax = plt.subplots()
t = np.linspace(0, 3, 40)
g = -9.81
v0 = 12
z = g * t**2 / 2 + v0 * t

v02 = 5
z2 = g * t**2 / 2 + v02 * t

scat = ax.scatter(t[0], z[0], c="b", s=5, label=f'v0 = {v0} m/s')
line2 = ax.plot(t[0], z2[0], label=f'v0 = {v02} m/s')[0]
ax.set(xlim=[0, 3], ylim=[-4, 10], xlabel='Time [s]', ylabel='Z [m]')
ax.legend()


def update(frame):
    # for each frame, update the data stored on each artist.
    x = t[:frame]
    y = z[:frame]
    # update the scatter plot:
    data = np.stack([x, y]).T
    scat.set_offsets(data)
    # update the line plot:
    line2.set_xdata(t[:frame])
    line2.set_ydata(z2[:frame])
    return (scat, line2)


ani = animation.FuncAnimation(fig=fig, func=update, frames=40, interval=30)
plt.show()
```

`ArtistAnimation`

`.matplotlib.animation.ArtistAnimation` can be used to generate animations if there is data stored

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example, when we use `.Axes.barh` to plot a bar-chart, it creates a number of artists for each of the bar and error bars. To update the plot, one would need to update each of the bars from the container individually and redraw them. Instead, `.animation.ArtistAnimation` can be used to plot each frame individually and then stitched together to form an animation. A barchart race is a simple example for this.

```
fig, ax = plt.subplots()
rng = np.random.default_rng(19680801)
data = np.array([20, 20, 20, 20])
x = np.array([1, 2, 3, 4])

artists = []
colors = ['tab:blue', 'tab:red', 'tab:green', 'tab:purple']
for i in range(20):
    data += rng.integers(low=0, high=10, size=data.shape)
    container = ax.barh(x, data, color=colors)
    artists.append(container)


ani = animation.ArtistAnimation(fig=fig, artists=artists, interval=400)
plt.show()
```

Animation Writers

Animation objects can be saved to disk using various multimedia writers (ex: Pillow, *ffpmeg*, *imagemagick*). Not all video formats are supported by all writers. There are 4 major types of writers:

- `~matplotlib.animation.PillowWriter` - Uses the Pillow library to create the animation.
- `~matplotlib.animation.HTMLWriter` - Used to create JavaScript-based animations.
- Pipe-based writers - `~matplotlib.animation.FFMpegWriter` and `~matplotlib.animation.ImageMagickWriter` are pipe based writers. These writers pipe each frame to the utility (*ffmpeg* | *imagemagick*) which then stitches all of them together to create the animation.
- File-based writers - `~matplotlib.animation.FFMpegFileWriter` and `~matplotlib.animation.ImageMagickFileWriter` are examples of file-based writers. These writers are slower than their pipe-based alternatives but are more useful for debugging as they save each frame in a file before stitching them together into an animation.

Skip to main content

.. list-table:: :header-rows: 1

- - Writer
  - Supported Formats
- - `~matplotlib.animation.PillowWriter`
  - .gif, .apng, .webp
- - `~matplotlib.animation.HTMLWriter`
  - .htm, .html, .png
- - | `~matplotlib.animation.FFMpegWriter` | `~matplotlib.animation.FFMpegFileWriter`
  - All formats supported by |ffmpeg|_: `ffmpeg -formats`
- - | `~matplotlib.animation.ImageMagickWriter` | `~matplotlib.animation.ImageMagickFileWriter`
  - All formats supported by |imagemagick|_: `magick -list format`

.. |ffmpeg| replace:: *ffmpeg*

.. |imagemagick| replace:: *imagemagick*

To save animations using any of the writers, we can use the `.animation.Animation.save` method. It takes the *filename* that we want to save the animation as and the *writer*, which is either a string or a writer object. It also takes an *fps* argument. This argument is different than the *interval* argument that `~.animation.FuncAnimation` or `~.animation.ArtistAnimation` uses. *fps* determines the frame rate that the **saved** animation uses, whereas *interval* determines the frame rate that the **displayed** animation uses.

Below are a few examples that show how to save an animation with different writers.

Pillow writers::

ani.save(filename=”/tmp/pillow_example.gif”, writer=”pillow”)
ani.save(filename=”/tmp/pillow_example.apng”, writer=”pillow”)

HTML writers::

ani.save(filename=”/tmp/html_example.html”, writer=”html”)
ani.save(filename=”/tmp/html_example.htm”, writer=”html”)
ani.save(filename=”/tmp/html_example.png”, writer=”html”)

Skip to main content

FFMpegWriter::

ani.save(filename=”/tmp/ffmpeg_example.mkv”, writer=”ffmpeg”)
ani.save(filename=”/tmp/ffmpeg_example.mp4”, writer=”ffmpeg”)
ani.save(filename=”/tmp/ffmpeg_example.mjpeg”, writer=”ffmpeg”)

Imagemagick writers::

ani.save(filename=”/tmp/imagemagick_example.gif”, writer=”imagemagick”)
ani.save(filename=”/tmp/imagemagick_example.webp”, writer=”imagemagick”)
ani.save(filename=”apng:/tmp/imagemagick_example.apng”, writer=”imagemagick”, extra_args=[“-quality”, “100”])

(the `extra_args` for *apng* are needed to reduce filesize by ~10x)

test phy msu animation

```
import  os
os.getcwd()
# os.chdir("")
```

```
'/Users/ngcchk/Documents/GitHub/gpd2-win-unity1/ipadred-rain/imgno_book1/imgnobk9'
```

Skip to main content

```python
import os
os.listdir(os.getcwd())
#os.listdir("/var/mobile/Containers/Data/Application/03AF0984-E7D3-402A-AC98-38B4F54E4D

'''
['_backend_gtk.py',
 'backend_template.py',
 'backend_qtcairo.py',
 'backend_qt.py',
 'backend_gtk3cairo.py',
 'backend_tkagg.py',
 'backend_gtk4agg.py',
 'web_backend',
 'backend_qt5agg.py',
 'backend_qt5.py',
 'backend_gtk3agg.py',
 'backend_cairo.py',
 'backend_pdf.py',
 'backend_wxagg.py',
 'backend_pgf.py',
 'backend_mixed.py',
 'backend_macosx.py',
 'backend_gtk4.py',
 '__init__.py',
 '__pycache__',
 'qt_editor',
 'backend_tkcairo.py',
 'backend_gtk3.py',
 'backend_wxcairo.py',
 'backend_nbagg.py',
 'backend_webagg_core.py',
 'backend_gtk4cairo.py',
 'backend_wx.py',
 'backend_qt5cairo.py',
 '_backend_tk.py',
 'qt_compat.py',
 'backend_svg.py',
 '_backend_pdf_ps.py',
 'backend_webagg.py',
 'backend_ps.py',
 'backend_qtagg.py',
 'backend_agg.py']
'''
```

```
"\n['_backend_gtk.py',\n 'backend_template.py',\n 'backend_qtcairo.py',\n 'backend_qt.p
```

Skip to main content

```
#import numpy as np
#import matplotlib.pyplot as plt
#import matplotlib.animation as animation
import matplotlib
import matplotlib.pyplot as plt
import matplotlib.patches as patches
import matplotlib.path as path
import matplotlib.animation as animation

import numpy as np
from scipy.spatial.distance import pdist, squareform

import matplotlib.pyplot as plt
import scipy.integrate as integrate
import matplotlib.animation as animation


# default nothing does not work here!!!
# %matplotlib
#%matplotlib qt
%matplotlib tk

print(matplotlib.matplotlib_fname())
'''
filename = matplotlib.matplotlib_fname() # "file.py"

#print("---- no line end")

#with open(filename) as f:
#    content = f.readlines()
#print(content)

print("---- with line end")

with open(filename,"r") as file: #'Fruit.txt',"r") as file:
    for line in file:
        #if InputText in line:
        print(line, end='')
        #print(line) #, end='')
        #print(next(file), end='')
        #break

# https://matplotlib.org/stable/users/explain/figure/backends.html
# The first usable backend in the following list is selected: MacOSX, QtAgg, GTK4Agg, G
# ... QtCairo
# ... ip...
'''
```

Skip to main content

```
/Users/ngcchk/miniconda3/lib/python3.11/site-packages/matplotlib/mpl-data/matplotlibrc
```

```
'\nfilename = matplotlib.matplotlib_fname() # "file.py"\n\n#print("---- no line end")\n
```

remember the simulation is another windows

need to close down before you can have another one

```
# test phy msu animationf
# from main import animate
#
#import matplotlib
#matplotlib.use("MacOSX")
'''
19: UserWarning: frames=<function data_gen at 0x115cb5120> which we can infer the lengt
  *save_count* and passed cache_frame_data=True.
  To avoid a possibly unbounded cache, frame data caching has been disabled.
  To suppress this warning either pass `cache_frame_data=False` or `save_count=MAX_FRAM
  ani = animation.FuncAnimation(fig, update, data_gen, interval=100)
'''


fig, ax = plt.subplots()
line, = ax.plot(np.random.rand(10))
ax.set_ylim(0, 1)


def update(data):
    line.set_ydata(data)
    return line,


def data_gen():
    while True:
        yield np.random.rand(10)

MY_INTERVAL = 100
MAX_FRAMES = 10 * MY_INTERVAL # 00 # > 100

ani = animation.FuncAnimation(fig, update, data_gen, interval=MY_INTERVAL, cache_frame_
                              #save_count=MAX_FRAMES) # not much a difference
                              #100, save_count=MAX_FRAMES) #)
                             )
plt.title('test_1 on tk individually at least but not restart run all cell')
plt.show()
```

Skip to main content

```
# test phy msu animationf
# from main import animate2

#import numpy as np
#import matplotlib.pyplot as plt
#import matplotlib.animation as animation


def data_gen(t=0):
    cnt = 0
    while cnt < 1000:
        cnt += 1
        t += 0.1
        yield t, np.sin(2*np.pi*t) * np.exp(-t/10.)


def init():
    ax.set_ylim(-1.1, 1.1)
    ax.set_xlim(0, 10)
    del xdata[:]
    del ydata[:]
    line.set_data(xdata, ydata)
    return line,

fig, ax = plt.subplots()
line, = ax.plot([], [], lw=2)
ax.grid()
xdata, ydata = [], []


def run(data):
    # update the data
    t, y = data
    xdata.append(t)
    ydata.append(y)
    xmin, xmax = ax.get_xlim()

    if t >= xmax:
        ax.set_xlim(xmin, 2*xmax)
        ax.figure.canvas.draw()
    line.set_data(xdata, ydata)

    return line,

MY_INTERVAL = 10
MAX_FRAMES = 10 * MY_INTERVAL # 00 # > 100


ani = animation.FuncAnimation(fig, run, data_gen, blit=False, interval=MY_INTERVAL, cac
                              # save_count=MAX_FRAMES, #10,
                              # <-- actually very different as it scale and scale and s
                              repeat=False, init_func=init)
plt.title('test_2 on tk run 2 times needed')
```

Skip to main content

```
/var/folders/33/krstvgns2rncl74r18tkv6_80000gn/T/ipykernel_32001/483570514.py:49: UserW
  ani = animation.FuncAnimation(fig, run, data_gen, blit=False, interval=MY_INTERVAL, c
```

```
# test phy msu animationf
# from main import animate3
#plt.close('all')
#import numpy as np
#import matplotlib.pyplot as plt
#import matplotlib.animation as animation

fig, ax = plt.subplots()

x = np.arange(0, 2*np.pi, 0.01)
line, = ax.plot(x, np.sin(x))


def animate(i):
    line.set_ydata(np.sin(x + i/10.0))  # update the data
    return line,


# Init only required for blitting to give a clean slate.
def init():
    line.set_ydata(np.ma.array(x, mask=True))
    return line,

ani = animation.FuncAnimation(fig, animate, np.arange(1, 200), init_func=init,
                              interval=25, blit=True)
plt.title('test_3 on tk')
plt.show()
```

```
/Users/ngcchk/miniconda3/lib/python3.11/site-packages/matplotlib/animation.py:892: User
  warnings.warn(
```

```
#plt.close('all')
```

Skip to main content

```
# test phy msu animationf
# from main import animate4

#import numpy as np
#import matplotlib
#import matplotlib.pyplot as plt
#import matplotlib.animation as animation

#matplotlib.use("Agg") # <-- Beacuse it save below, it is ok!!!!!


def update_line(num, data, line):
    line.set_data(data[..., :num])
    return line,

# Set up formatting for the movie files
Writer = animation.writers['ffmpeg']  # <--
writer = Writer(fps=15, metadata=dict(artist='Me'), bitrate=1800)  # <--


fig1 = plt.figure()

data = np.random.rand(2, 25)
l, = plt.plot([], [], 'r-')
plt.xlim(0, 1)
plt.ylim(0, 1)
plt.xlabel('x')
plt.title('test_4a line ok on tk')
line_ani = animation.FuncAnimation(fig1, update_line, 25, fargs=(data, l),
                                   interval=50, blit=True)
line_ani.save('lines_4.mp4', writer=writer)  # <--

fig2 = plt.figure()

x = np.arange(-9, 10)
y = np.arange(-9, 10).reshape(-1, 1)
base = np.hypot(x, y)
ims = []
for add in np.arange(15):
    ims.append((plt.pcolor(x, y, base + add, norm=plt.Normalize(0, 30)),))

im_ani = animation.ArtistAnimation(fig2, ims, interval=50, repeat_delay=3000,
                                   blit=True)
im_ani.save('im_4.mp4', writer=writer)  # <--

plt.title('test_4b grid colour map ok on tk')
plt.show()
```

```
#plt.close('all')
```

Skip to main content

```python
# test phy msu animationf
# matplotlib.use("MacOSX") # <-- need this as no save
# from main import animate5

#import numpy as np
#import matplotlib.pyplot as plt
#import matplotlib.animation as animation


def update_line(num, data, line):
    line.set_data(data[..., :num])
    return line,

fig1 = plt.figure()

data = np.random.rand(2, 25)
l, = plt.plot([], [], 'r-')
plt.xlim(0, 1)
plt.ylim(0, 1)
plt.xlabel('x')
plt.title('test_5_fig1 ok on tk')
line_ani = animation.FuncAnimation(fig1, update_line, 25, fargs=(data, l),
                                   interval=50, blit=True)


fig2 = plt.figure()
plt.title('test_5_fig2 nok on tk')

x = np.arange(-9, 10)
y = np.arange(-9, 10).reshape(-1, 1)
base = np.hypot(x, y)
ims = []
for add in np.arange(15):
    ims.append((plt.pcolor(x, y, base + add, norm=plt.Normalize(0, 30)),))

im_ani = animation.ArtistAnimation(fig2, ims, interval=50, repeat_delay=3000,
                                   blit=True)
# To save this second animation with some metadata, use the following command:
# im_ani.save('im.mp4', metadata={'artist':'Guido'})

plt.title('test_5_fig2 again ok on tk')
plt.show()
```

```python
#plt.close('all')
```

Skip to main content

```
# test phy msu animationf
# matplotlib.use("MacOSX")
# from main import animate6

#import numpy as np

#import matplotlib.pyplot as plt
#import matplotlib.patches as patches
#import matplotlib.path as path
#import matplotlib.animation as animation

fig, ax = plt.subplots()

# histogram our data with numpy
data = np.random.randn(1000)
n, bins = np.histogram(data, 100)

# get the corners of the rectangles for the histogram
left = np.array(bins[:-1])
right = np.array(bins[1:])
bottom = np.zeros(len(left))
top = bottom + n
nrects = len(left)

# here comes the tricky part -- we have to set up the vertex and path
# codes arrays using moveto, lineto and closepoly

# for each rect: 1 for the MOVETO, 3 for the LINETO, 1 for the
# CLOSEPOLY; the vert for the closepoly is ignored but we still need
# it to keep the codes aligned with the vertices
nverts = nrects*(1 + 3 + 1)
verts = np.zeros((nverts, 2))
codes = np.ones(nverts, int) * path.Path.LINETO
codes[0::5] = path.Path.MOVETO
codes[4::5] = path.Path.CLOSEPOLY
verts[0::5, 0] = left
verts[0::5, 1] = bottom
verts[1::5, 0] = left
verts[1::5, 1] = top
verts[2::5, 0] = right
verts[2::5, 1] = top
verts[3::5, 0] = right
verts[3::5, 1] = bottom

barpath = path.Path(verts, codes)
patch = patches.PathPatch(
    barpath, facecolor='green', edgecolor='yellow', alpha=0.5)
ax.add_patch(patch)

ax.set_xlim(left[0], right[-1])
ax.set_ylim(bottom.min(), top.max())
```

Skip to main content

```
    data = np.random.randn(1000)
    n, bins = np.histogram(data, 100)
    top = bottom + n
    verts[1::5, 1] = top
    verts[2::5, 1] = top
    return [patch, ]

plt.title('test_6 not working under qt but can work under tk')
ani = animation.FuncAnimation(fig, animate, 100, repeat=False, blit=True)
plt.show()
```

```
#plt.close('all')
```

Skip to main content

```
# test phy msu animationf
# matplotlib.use("MacOSX")
# from main import animate7

"""
Animation of Elastic collisions with Gravity

author: Jake Vanderplas
email: vanderplas@astro.washington.edu
website: http://jakevdp.github.com
license: BSD
Please feel free to use and modify this, but keep the above information. Thanks!
"""

#import matplotlib.pyplot as plt
#import matplotlib.patches as patches
#import matplotlib.path as path
#import matplotlib.animation as animation

#import numpy as np
#from scipy.spatial.distance import pdist, squareform

#import matplotlib.pyplot as plt
#import scipy.integrate as integrate
#import matplotlib.animation as animation

class ParticleBox:
    """Orbits class

    init_state is an [N x 4] array, where N is the number of particles:
       [[x1, y1, vx1, vy1],
        [x2, y2, vx2, vy2],
        ...               ]

    bounds is the size of the box: [xmin, xmax, ymin, ymax]
    """
    def __init__(self,
                 init_state = [[1, 0, 0, -1],
                               [-0.5, 0.5, 0.5, 0.5],
                               [-0.5, -0.5, -0.5, 0.5]],
                 bounds = [-2, 2, -2, 2],
                 size = 0.04,
                 M = 0.05,
                 G = 9.8):
        self.init_state = np.asarray(init_state, dtype=float)
        self.M = M * np.ones(self.init_state.shape[0])
        self.size = size
        self.state = self.init_state.copy()
        self.time_elapsed = 0
        self.bounds = bounds
        self.G = G

    def step(self, dt):
```

Skip to main content

```
        # update positions
        self.state[:, :2] += dt * self.state[:, 2:]

        # find pairs of particles undergoing a collision
        D = squareform(pdist(self.state[:, :2]))
        ind1, ind2 = np.where(D < 2 * self.size)
        unique = (ind1 < ind2)
        ind1 = ind1[unique]
        ind2 = ind2[unique]

        # update velocities of colliding pairs
        for i1, i2 in zip(ind1, ind2):
            # mass
            m1 = self.M[i1]
            m2 = self.M[i2]

            # location vector
            r1 = self.state[i1, :2]
            r2 = self.state[i2, :2]

            # velocity vector
            v1 = self.state[i1, 2:]
            v2 = self.state[i2, 2:]

            # relative location & velocity vectors
            r_rel = r1 - r2
            v_rel = v1 - v2

            # momentum vector of the center of mass
            v_cm = (m1 * v1 + m2 * v2) / (m1 + m2)

            # collisions of spheres reflect v_rel over r_rel
            rr_rel = np.dot(r_rel, r_rel)
            vr_rel = np.dot(v_rel, r_rel)
            v_rel = 2 * r_rel * vr_rel / rr_rel - v_rel

            # assign new velocities
            self.state[i1, 2:] = v_cm + v_rel * m2 / (m1 + m2)
            self.state[i2, 2:] = v_cm - v_rel * m1 / (m1 + m2)

        # check for crossing boundary
        crossed_x1 = (self.state[:, 0] < self.bounds[0] + self.size)
        crossed_x2 = (self.state[:, 0] > self.bounds[1] - self.size)
        crossed_y1 = (self.state[:, 1] < self.bounds[2] + self.size)
        crossed_y2 = (self.state[:, 1] > self.bounds[3] - self.size)

        self.state[crossed_x1, 0] = self.bounds[0] + self.size
        self.state[crossed_x2, 0] = self.bounds[1] - self.size

        self.state[crossed_y1, 1] = self.bounds[2] + self.size
        self.state[crossed_y2, 1] = self.bounds[3] - self.size

        self.state[crossed_x1 | crossed_x2, 2] *= -1
```

Skip to main content

```
        # add gravity
        self.state[:, 3] -= self.M * self.G * dt


#------------------------------------------------------------
# set up initial state
np.random.seed(0)
init_state = -0.5 + np.random.random((50, 4))
init_state[:, :2] *= 3.9

box = ParticleBox(init_state, size=0.04)
dt = 1. / 30 # 30fps


#------------------------------------------------------------
# set up figure and animation
fig = plt.figure()
# err fig.title ...
# plt.title('test_7') # <-- try here ands down below; both no effect
fig.subplots_adjust(left=0, right=1, bottom=0, top=1)
ax = fig.add_subplot(111, aspect='equal', autoscale_on=False,
                     xlim=(-3.2, 3.2), ylim=(-2.4, 2.4))
# err as well ax.title('test_7_ax')

# particles holds the locations of the particles
particles, = ax.plot([], [], 'bo', ms=6)

# rect is the box edge
rect = plt.Rectangle(box.bounds[::2],
                     box.bounds[1] - box.bounds[0],
                     box.bounds[3] - box.bounds[2],
                     ec='none', lw=2, fc='none')
ax.add_patch(rect)

def init():
    """initialize animation"""
    global box, rect
    particles.set_data([], [])
    rect.set_edgecolor('none')
    return particles, rect

def animate(i):
    """perform animation step"""
    global box, rect, dt, ax, fig
    box.step(dt)

    ms = int(fig.dpi * 2 * box.size * fig.get_figwidth()
             / np.diff(ax.get_xbound())[0])

    # update pieces of the animation
    rect.set_edgecolor('k')
    particles.set_data(box.state[:, 0], box.state[:, 1])
    particles.set_markersize(ms)
    return particles, rect
```

Skip to main content

```
# still no fig.title

ani = animation.FuncAnimation(fig, animate, frames=600,
                              interval=10, blit=True, init_func=init)


# save the animation as an mp4.  This requires ffmpeg or mencoder to be
# installed.  The extra_args ensure that the x264 codec is used, so that
# the video can be embedded in html5.  You may need to adjust this for
# your system: for more information, see
# http://matplotlib.sourceforge.net/api/animation_api.html
#ani.save('particle_box.mp4', fps=30, extra_args=['-vcodec', 'libx264'])


ani.save('teset_7_particle_box.mp4', fps=30, extra_args=['-vcodec', 'libx264'])
plt.title("teset 7 not mp4 ok tk not shown in title though") # there but the windows to

plt.show() # the show is not the .mp4 version
```

```
#plt.close('all')
```

mpl3 cook1

```
import numpy as np
import matplotlib.pyplot as plt
from matplotlib.transforms import Affine2D
import mpl_toolkits.axisartist.floating_axes as floating_axes
from matplotlib.projections import PolarAxes
import mpl_toolkits.axisartist.angle_helper as angle_helper
from mpl_toolkits.axisartist.grid_finder import MaxNLocator
```