

# Python 7: Matplotlib

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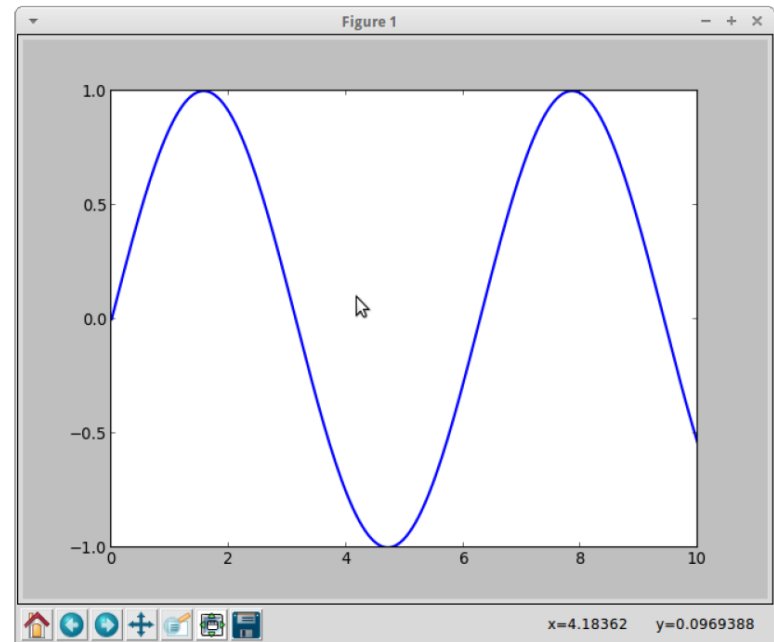
금융공학 프로그래밍 I

# Intro to Matplotlib

## ❖ Overview

- 2D and 3D plots

```
import matplotlib.pyplot as plt
import numpy as np
x = np.linspace(0, 10, 200)
y = np.sin(x)
plt.plot(x, y, 'b-', linewidth=2)
plt.show()
```



# More preferred way

## ❖ More Pythonic

- Explicit style of programming

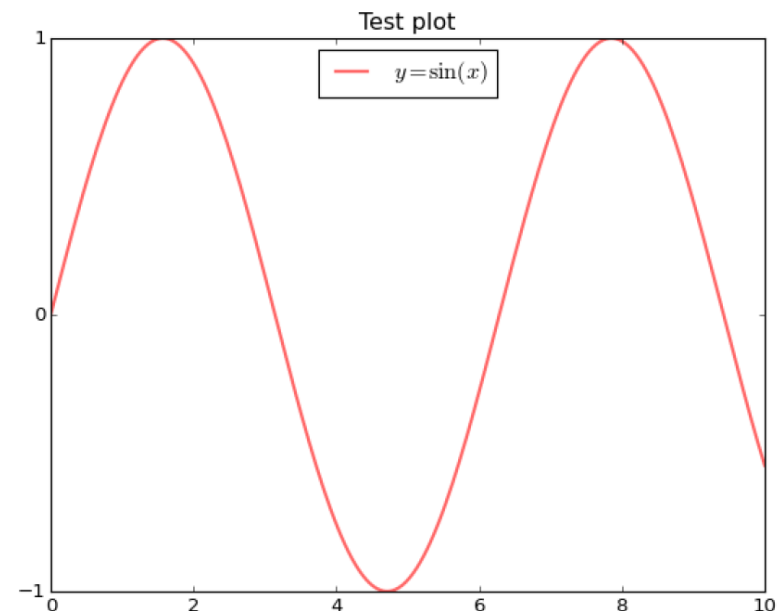
```
import matplotlib.pyplot as plt
import numpy as np
fig, ax = plt.subplots()
x = np.linspace(0, 10, 200)
y = np.sin(x)
ax.plot(x, y, 'b-', linewidth=2)
plt.show()
```

- fig is a Figure instance – like a blank canvas
- ax is an AxesSubplot instance
- plot() function is actually a method of ax

# Something more

```
import matplotlib.pyplot as plt
import numpy as np
fig, ax = plt.subplots()
x = np.linspace(0, 10, 200)
y = np.sin(x)
ax.plot(x, y, 'r-', linewidth=2, label=r'$y=\sin(x)$', alpha=0.6)
ax.legend(loc='upper center')
ax.set_yticks([-1, 0, 1])
ax.set_title('Test plot')
plt.show()
```

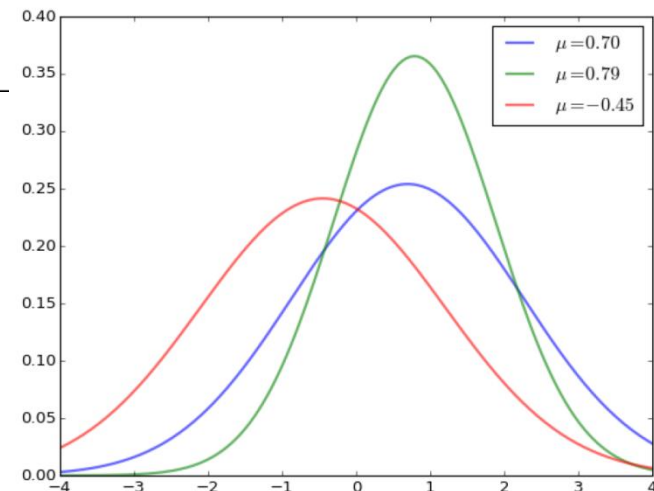
- ❖ Title
- ❖ linewidth
- ❖ label & legend
- ❖ LaTeX



# Multiple Plots on One Axis

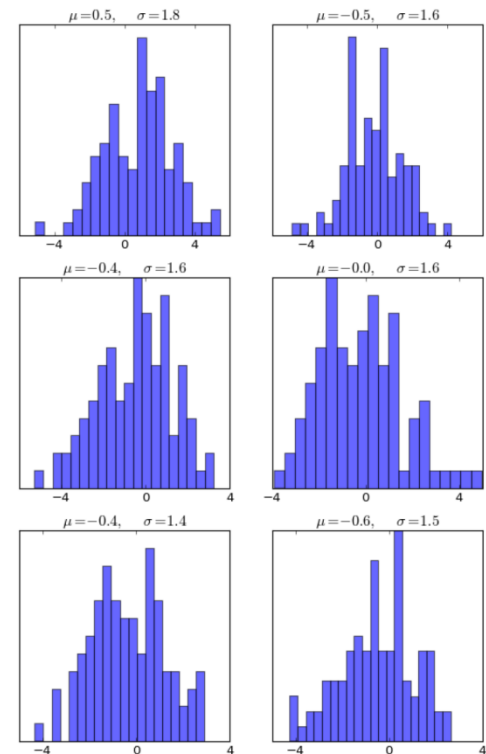
```
import matplotlib.pyplot as plt
import numpy as np
from scipy.stats import norm
from random import uniform

fig, ax = plt.subplots()
x = np.linspace(-4, 4, 150)
for i in range(3):
    m, s = uniform(-1, 1), uniform(1, 2)
    y = norm.pdf(x, loc=m, scale=s)
    current_label = r'$\mu = {0:.2f}$'.format(m)
    ax.plot(x, y, linewidth=2, alpha=0.6, label=current_label)
ax.legend()
plt.show()
```



# Multiple Subplot

```
import matplotlib.pyplot as plt
from scipy.stats import norm
from random import uniform
num_rows, num_cols = 3, 2
fig, axes = plt.subplots(num_rows, num_cols, figsize=(8, 12))
for i in range(num_rows):
    for j in range(num_cols):
        m, s = uniform(-1, 1), uniform(1, 2)
        x = norm.rvs(loc=m, scale=s, size=100)
        axes[i, j].hist(x, alpha=0.6, bins=20)
        t = r'$\mu = {0:.1f}, \quad \sigma = {1:.1f}$'.format(m, s)
        axes[i, j].set_title(t)
        axes[i, j].set_xticks([-4, 0, 4])
        axes[i, j].set_yticks([])
plt.show()
```



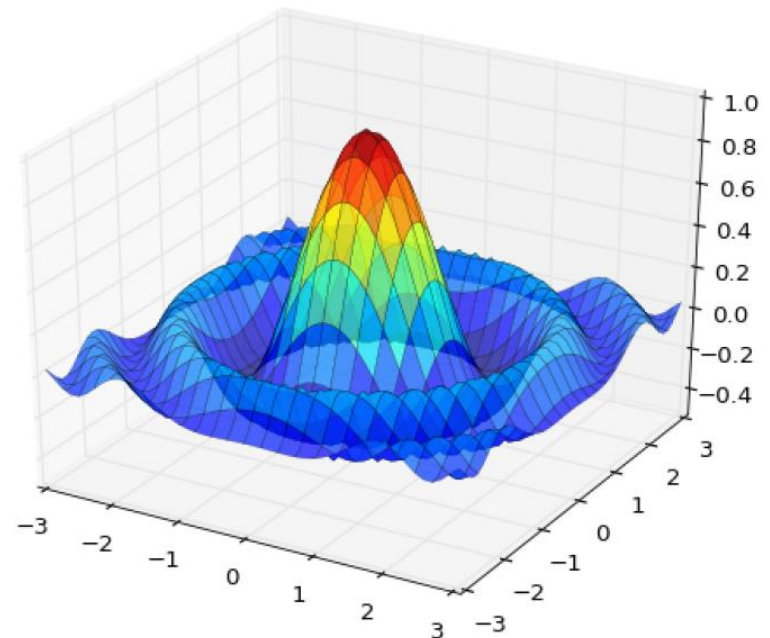
# 3D Plots

```
import matplotlib.pyplot as plt
from mpl_toolkits.mplot3d.axes3d import Axes3D
import numpy as np
from matplotlib import cm

def f(x, y):
    return np.cos(x**2 + y**2) / (1 + x**2 + y**2)

xgrid = np.linspace(-3, 3, 50)
ygrid = xgrid
x, y = np.meshgrid(xgrid, ygrid)

fig = plt.figure(figsize=(8, 6))
ax = fig.add_subplot(111, projection='3d')
ax.plot_surface(x,
               y,
               f(x, y),
               rstride=2, cstride=2,
               cmap=cm.jet,
               alpha=0.7,
               linewidth=0.25)
ax.set_zlim(-0.5, 1.0)
plt.show()
```



# **Q & A**

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