Matplotlib

Matplotlib

- 2D-graphics을 위한 파이썬 라이브러리
  - 빠른 데이터 시각화 기능 제공
  - 다양한 저장 포맷 지원

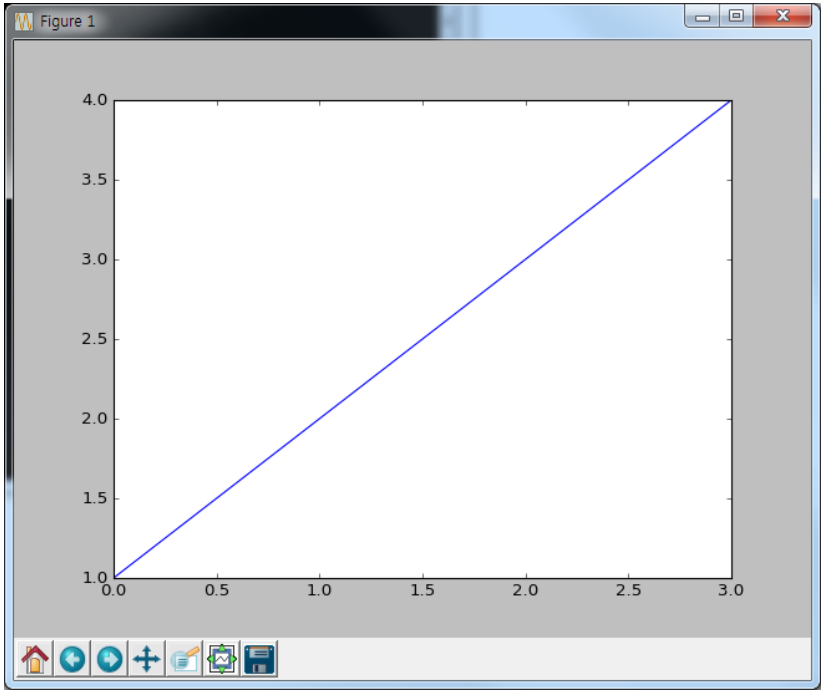
```
설치 : python –m pip install matplotlib
```

- pyplot
  - Matlab과 유사한 사용법을 제공해 줌

```
from matplotlib import pyplot as plt
```

PyPlot

```
plt.plot([1,2,3,4])
plt.show()
```



- 하나의 리스트나 배열이 주어질 경우, y축 값으로 처리
  - x축 값은 0부터 같은 길이의 벡터를 만듦

```
plt.plot([1, 2, 3, 4], [1, 4, 9, 16])
```

x y

- 축 [xmin, xmax, ymin, ymax]

PyPlot

- Line style
  - Default style : ‘b-’ (solid blue line)

```
plt.plot([1, 2, 3, 4], [1, 4, 9, 16], ‘ro’)
```

character	description
'-'	solid line style
'--'	dashed line style
'-.'	dash-dot line style
':'	dotted line style
'.'	point marker
','	pixel marker
'o'	circle marker

'v'	triangle_down marker
'^'	triangle_up marker
'<'	triangle_left marker
'>'	triangle_right marker
'1'	tri_down marker
'2'	tri_up marker
'3'	tri_left marker
'4'	tri_right marker

PyPlot

- Line style
  - color

character	color
‘b’	blue
‘g’	green
‘r’	red
‘c’	cyan

character	color
‘m’	magenta
‘y’	yellow
‘k’	black
‘w’	white

```
t = np.arange(0., 5., 0.2)
plt.plot(t, t, 'r--', t, t**2, 'bs', t, t**3, 'g^')
plt.show()
```

PyPlot

- Adding a legend

```
plt.plot(X, C, color="blue", linewidth=2.5, linestyle="-", label="cosine")
plt.plot(X, S, color="red", linewidth=2.5, linestyle="-", label="sine")
plt.legend(loc='upper left')
```

PyPlot

```
# Create a figure of size 8x6 inches, 80 dots per inch
plt.figure(figsize=(8, 6), dpi=80)

# Create a new subplot from a grid of 1x1 (row, col, viewpos)
plt.subplot(1, 1, 1)

X = np.linspace(-np.pi, np.pi, 256, endpoint=True)
C, S = np.cos(X), np.sin(X)

# Plot cosine with a blue continuous line of width 1 (pixels)
plt.plot(X, C, color="blue", linewidth=1.0, linestyle="-")

# Plot sine with a green continuous line of width 1 (pixels)
plt.plot(X, S, color="green", linewidth=1.0, linestyle="-")
```

PyPlot

```
# Set x limits
plt.xlim(-4.0, 4.0)

# Set x ticks
plt.xticks(np.linspace(-4, 4, 9, endpoint=True))

# Set y limits
plt.ylim(-1.0, 1.0)

# Set y ticks
plt.yticks(np.linspace(-1, 1, 5, endpoint=True))

plt.show()
```

PyPlot

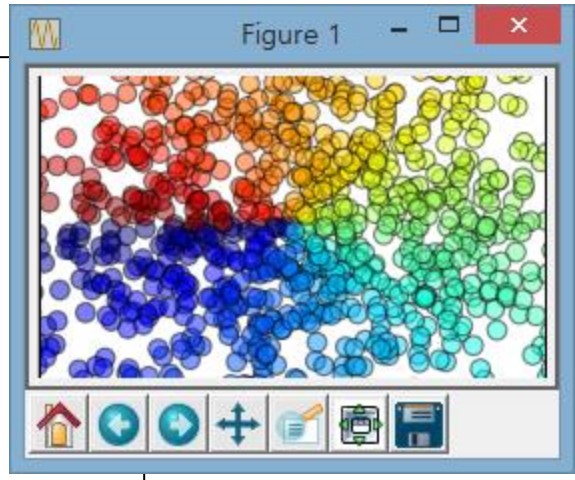
```
def f(t):
    return np.exp(-t) * np.cos(2*np.pi*t)

t1 = np.arange(0.0, 5.0, 0.1)
t2 = np.arange(0.0, 5.0, 0.02)

plt.figure(1)
plt.subplot(211)
plt.plot(t1, f(t1), 'bo', t2, f(t2), 'k')

plt.subplot(212)
plt.plot(t2, np.cos(2*np.pi*t2), 'r--')
plt.show()
```

PyPlot

- Spine
  - 축의 tick marks과 연결된 라인

```
ax = plt.gca()  # gca stands for 'get current axis'
ax.spines['right'].set_color('none')
ax.spines['top'].set_color('none')
ax.xaxis.set_ticks_position('bottom')
ax.spines['bottom'].set_position(('data',0))
ax.yaxis.set_ticks_position('left')
ax.spines['left'].set_position(('data',0))
```

Regular Plots

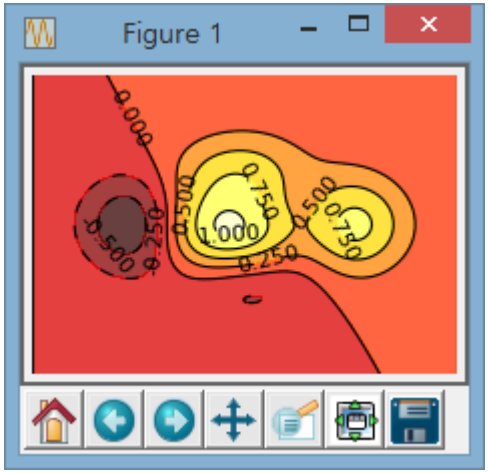



```
n = 1024
X = np.random.normal(0, 1, n)
Y = np.random.normal(0, 1, n)
T = np.arctan2(Y, X)

plt.axes([0.025, 0.025, 0.95, 0.95])
plt.scatter(X, Y, s=75, c=T, alpha=.5)

plt.xlim(-1.5, 1.5)
plt.xticks(())
plt.ylim(-1.5, 1.5)
plt.yticks(())

plt.show()
```

*s: size of points
*c: color, sequence of color

Contour Plots

```
def f(x,y):
    return (1 - x / 2 + x**5 + y**3) * np.exp(-x**2 -y**2)

n = 256
x = np.linspace(-3, 3, n)
y = np.linspace(-3, 3, n)
X,Y = np.meshgrid(x, y)

plt.axes([0.025, 0.025, 0.95, 0.95])

plt.contourf(X, Y, f(X, Y), 8, alpha=.75, cmap=plt.cm.hot)
C = plt.contour(X, Y, f(X, Y), 8, colors='black', linewidth=.5)
plt.clabel(C, inline=1, fontsize=10)

plt.xticks(())
plt.yticks(())
plt.show()
```



* contourf : draw filled contours
* contour : draw contour lines
-. X, Y : 좌표
-. f(X,Y) : contour plot
-. 8 : 주어진 레벨까지 선택

Imshow

```
def f(x, y):
    return (1 - x / 2 + x ** 5 + y ** 3 ) * np.exp(-x ** 2 - y ** 2)

n = 10
x = np.linspace(-3, 3, 3.5 * n)
y = np.linspace(-3, 3, 3.0 * n)
X, Y = np.meshgrid(x, y)
Z = f(X, Y)

plt.axes([0.025, 0.025, 0.95, 0.95])
plt.imshow(Z, interpolation='nearest', cmap='bone', origin='lower')
plt.colorbar(shrink=.92)

plt.xticks(())
plt.yticks(())
plt.show()
```