Problem-Based Learning Python 3

Lecture: 3-function

Online Python

- https://python-fiddle.com

Lecture Notes

- https://web.phy.ntnu.edu.tw/~hongyi/?url=notes

變數(variable)和函數(function)

- 變數

```
c = 1.0
```

- 一般函數

```
y = input(1.0)
print(y)
```

- 數學函數

```
y = float(60)
y = int(3.14)
y = round(3.14159265, 2)
```

數學函數(function)

```
import numpy as np
x = np.linspace(-np.pi, np.pi, 100)
y = np.cos(x)
print(y)
```

```
# x在−π到π之間取100個元素
# 將產生的x元素，代入cos()產生對應y值
```

數學函數(function)

```
import matplotlib.pyplot as plt
import numpy as np
x = np.linspace(-np.pi, np.pi, 100)  # x在−π到π之間取100個元素
y = np.cos(x)                        # 將產生的x元素，代入cos()產生對應y值
plt.plot(x, y)
plt.show()
```

Matplotlib

- `import matplotlib.pyplot as plt`
- `import numpy as np`
- `x = np.linspace(-np.pi, np.pi, 100)`
- `y = np.cos(x)`
- `plt.plot(x, y, label="Cosine")` # Legend “Cosine”
- `plt.legend(loc="upper left")`
- `plt.show()`

Matplotlib

- `import matplotlib.pyplot as plt`
- `import numpy as np`
- `x = np.linspace(-np.pi, np.pi, 100)`
- `y = np.cos(x)`
- `plt.plot(x, y, label="Cosine")`
- `plt.legend(loc="upper left")`
- `plt.xlabel(r"$\theta$")`
- `plt.ylabel(r"$cos(\theta)$")`
- `plt.show()`

Matplotlib

- `import matplotlib.pyplot as plt`
- `import numpy as np`
- `y = [1320,1283,1274,1291,1339,1412,1502,1602,1699,1782,1839,1866,1853,1805,1729,1637,1541,1446,1363,1305]`
- `x = range(0, len(y), 1)`
- `plt.scatter(x, y, label="Data")`
- `plt.legend(loc="best", fontsize=14)`
- `plt.xlabel("Frame number", fontsize=14)`
- `plt.ylabel("Pixel position", fontsize=14)`
- `plt.show()`

Matplotlib

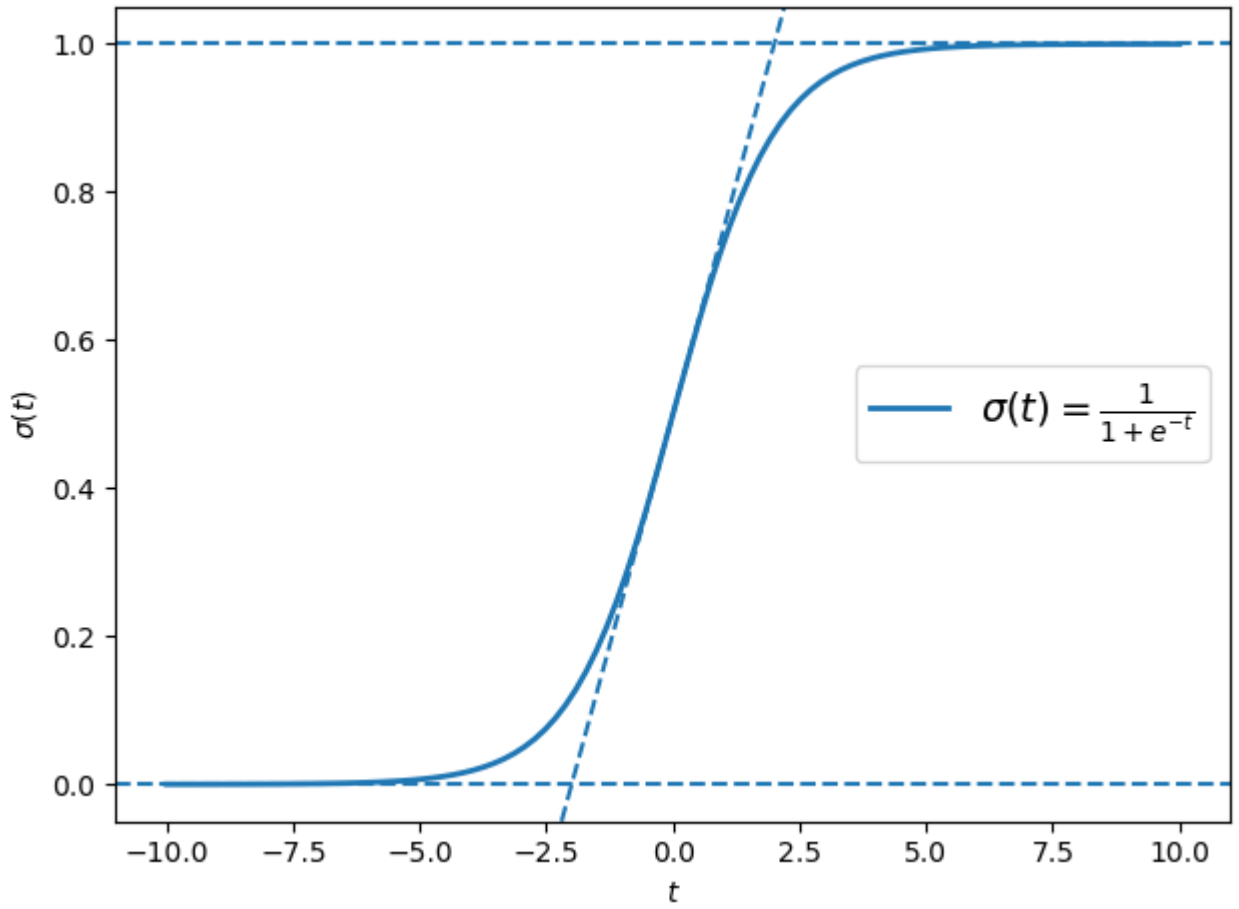
- `import matplotlib.pyplot as plt`
- `import numpy as np`
- `y = [1320,1283,1274,1291,1339,1412,1502,1602,1699,1782,1839,1866,1853,1805,1729,1637,1541,1446,1363,1305]`
- `x = range(0, len(y), 1)`
- `plt.axhline(y=1400, linestyle="--")`
- `plt.axhline(y=1700, linestyle="--")`
- `plt.axline((7, 1602), slope=98, linestyle="--")`
- `plt.scatter(x, y, label="Data")`
- `plt.legend(loc="best", fontsize=14)`
- `plt.xlabel("Frame number")`
- `plt.ylabel("Pixel position")`
- `plt.show()`

自訂函數

```
import numpy as np
def f(x,y):
    return (1-x/2+x**5+y**3)*np.exp(-x**2-y**2)
n = 16
x = np.linspace(-3, 3, n)
y = np.linspace(-3, 3, n)
print(f(x,y))
```

Problem

- 使用matplotlib畫出下邊的圖



Solution