

```

1 # 5-6.py
2 # 使用言語 python3
3
4 import numpy as np
5 import matplotlib.pyplot as plt
6
7
8 # サンプルデータの定義 =====
9 N = 16          # Signal length
10 y = np.array([0,0,0,0,0.1,0.42,0.72,0.58,0,-0.58,-0.72,-0.42,-0.10,0,0,0])
11 x1 = np.array([0,0.1,0.42,0.72,0.58,0,-0.58,-0.72,-0.42,-0.10,0,0,0,0,0,0])
12 x2 = x1 + 0.7
13 x3 = x1 * 1.5
14 # 自己相関関数
15 Rr = [0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0]
16 def correlate(x, y):
17     for m in range(-N+1, N-1):
18         for n in range(N-1):
19             if(n+m) < 0:
20                 continue
21             if(n+m) >= N:
22                 break
23             Rr[m] += x[n] * y[n+m]
24             Rr[m] = Rr[m] / (N-abs(m))
25     return Rr
26
27 def cross_covariance(x, y):
28      $\mu_x$  = np.average(x)
29      $\mu_y$  = np.average(y)
30     for m in range(-N+1, N-1):
31         for n in range(N-1):
32             if(n+m) < 0:
33                 continue
34             if(n+m) >= N:
35                 break
36             Rr[m] += (x[n] -  $\mu_x$ ) * (y[n+m] -  $\mu_y$ )
37             Rr[m] = Rr[m] / (N-abs(m))
38     return Rr
39
40 # 標準偏差
41
42 def cross_corelation(x, y):
43      $\sigma_x$  = np.std(x)
44      $\sigma_y$  = np.std(y)
45      $\mu_x$  = np.average(x)
46      $\mu_y$  = np.average(y)
47     for m in range(-N+1, N-1):
48         for n in range(N-1):
49             if(n+m) < 0:
50                 continue
51             if(n+m) >= N:
52                 break
53             Rr[m] += (x[n] -  $\mu_x$ ) * (y[n+m] -  $\mu_y$ )
54             Rr[m] = Rr[m] / (N-abs(m))
55             Rr[m] = Rr[m] / ( $\sigma_x$  *  $\sigma_y$ )
56     return Rr
57
58 plt.figure()
59 Rr = correlate(y, x1)
60 Rr = np.roll(Rr, N)
61 plt.plot(Rr)
62 plt.title("5-7, y, x1 correlation")
63 plt.savefig("5-7-y-x1-correlation.png")
64
65 plt.figure()
66 Rr = cross_covariance(y, x1)
67 Rr = np.roll(Rr, N)

```

```
68 plt.plot(Rr)
69 plt.title("5-7, y, x1 cross_covariance")
70 plt.savefig("5-7-y-x1-cross_covariance.png")
71
72 plt.figure()
73 Rr = cross_corelation(y, x1)
74 Rr = np.roll(Rr, N)
75 plt.plot(Rr)
76 plt.title("5-7, y, x1 cross_corelation")
77 plt.savefig("5-7-y-x1-cross_corelation.png")
78
79 plt.figure()
80 Rr = correlate(y, x2)
81 Rr = np.roll(Rr, N)
82 plt.plot(Rr)
83 plt.title("5-7, y, x2 correlation")
84 plt.savefig("5-7-y-x2-correlation.png")
85
86 plt.figure()
87 Rr = cross_covariance(y, x2)
88 Rr = np.roll(Rr, N)
89 plt.plot(Rr)
90 plt.title("5-7, y, x2 cross_covariance")
91 plt.savefig("5-7-y-x2-cross_covariance.png")
92
93 plt.figure()
94 Rr = cross_corelation(y, x2)
95 Rr = np.roll(Rr, N)
96 plt.plot(Rr)
97 plt.title("5-7, y, x2 cross_corelation")
98 plt.savefig("5-7-y-x2-cross_corelation.png")
99
100 plt.figure()
101 Rr = correlate(y, x3)
102 Rr = np.roll(Rr, N)
103 plt.plot(Rr)
104 plt.title("5-7, y, x3 correlation")
105 plt.savefig("5-7-y-x3-correlation.png")
106
107 plt.figure()
108 Rr = cross_covariance(y, x3)
109 Rr = np.roll(Rr, N)
110 plt.plot(Rr)
111 plt.title("5-7, y, x3 cross_covariance")
112 plt.savefig("5-7-y-x3-cross_covariance.png")
113
114 plt.figure()
115 Rr = cross_corelation(y, x3)
116 Rr = np.roll(Rr, N)
117 plt.plot(Rr)
118 plt.title("5-7, y, x3 cross_corelation")
119 plt.savefig("5-7-y-x3-cross_corelation.png")
```