

[실습예제 11-2][도전!]

```
11 def E(m,a,b):
12     val = 0.0
13     for i in range(N):
14         val += (m*np.arctan(a*x[i]+b)-t[i])**2
15     return 0.5*val/N
16
17 def Em(m,a,b):
18     val = 0.0
19     for i in range(N):
20         val += (m*np.arctan(a*x[i]+b)-t[i])*np.arctan(a*x[i]+b)
21     return val/N
22
23 def Ea(m,a,b):
24     val = 0.0
25     for i in range(N):
26         val += (m*np.arctan(a*x[i]+b)-t[i])*m/(1+(a*x[i]+b)**2)*x[i]
27     return val/N
28
29 def Eb(m,a,b):
30     val = 0.0
31     for i in range(N):
32         val += (m*np.arctan(a*x[i]+b)-t[i])*m/(1+(a*x[i]+b)**2)
33     return val/N
34
35 om, oa, ob = np.random.rand(), np.random.rand(), np.random.rand()
36 MaxIter = 2000
37 ns = MaxIter/10
38 alpha = 0.5
39 print('n={:4d}, En={:.4f}'.format(0,E(om,oa,ob)))
40 for n in range(MaxIter):
41     gradm, grada, gradb = Em(om,oa,ob), Ea(om,oa,ob), Eb(om,oa,ob)
42     nm, na, nb = om-alpha*gradm, oa-alpha*grada, ob-alpha*gradb
43     err = np.sqrt((nm-om)**2+(na-oa)**2+(nb-ob)**2)
44     om, oa, ob = nm, na, nb
45     if (n+1)%ns == 0:
46         print('n={:4d}, En={:.4f}'.format(n+1,E(om,oa,ob)))
47     if err < 1.0e-3:
48         break
49
50 print('n={:4d}, En={:.4f}'.format(n+1,E(om,oa,ob)))
```

```
n=    0, En=0.5964
n=   200, En=0.0456
n=   400, En=0.0402
n=   600, En=0.0378
n=   800, En=0.0365
n=  1000, En=0.0357
n=  1200, En=0.0351
n=  1291, En=0.0349
```

```
51 xx = np.linspace(-1, 1, 100)
```

```
52 yy = om*np.arctan(oa*xx+ob)
53 plt.plot(xx, yy, 'r--')
54 plt.plot(x, t, 'k.')
55 plt.show()
```

