

```

1 import numpy as np
2 # for AND gate (Input/Output)
3 x_list = np.array([[0,0],[0,1],[1,0],[1,1]])
4 y_list = np.array([0,0,0,1])
5 epochs = 6
6 w,b = np.zeros(2),0
7
8 for _ in range(epochs):
9     for x,y in zip(x_list,y_list):
10         z = np.dot(x,w) + b
11         ### condition area for y_pred
12         y_pred = 1 if z >= 0 else 0
13         E = y - y_pred
14         print("error : ",E,"<- at epoch",_)
15         w += E*x
16         b += E
17     print(w,b)

```

```

error : -1 <- at epoch 0
[0. 0.] -1
error : 0 <- at epoch 0
[0. 0.] -1
error : 0 <- at epoch 0
[0. 0.] -1
error : 1 <- at epoch 0
[1. 1.] 0
error : -1 <- at epoch 1
[1. 1.] -1
error : -1 <- at epoch 1
[1. 0.] -2
error : 0 <- at epoch 1
[1. 0.] -2
error : 1 <- at epoch 1
[2. 1.] -1
error : 0 <- at epoch 2
[2. 1.] -1
error : -1 <- at epoch 2
[2. 0.] -2
error : -1 <- at epoch 2
[1. 0.] -3
error : 1 <- at epoch 2
[2. 1.] -2
error : 0 <- at epoch 3
[2. 1.] -2
error : 0 <- at epoch 3
[2. 1.] -2
error : -1 <- at epoch 3
[1. 1.] -3
error : 1 <- at epoch 3
[2. 2.] -2
error : 0 <- at epoch 4
[2. 2.] -2
error : -1 <- at epoch 4
[2. 1.] -3
error : 0 <- at epoch 4
[2. 1.] -3
error : 0 <- at epoch 4
[2. 1.] -3
error : 0 <- at epoch 5
[2. 1.] -3
error : 0 <- at epoch 5
[2. 1.] -3
error : 0 <- at epoch 5
[2. 1.] -3
error : 0 <- at epoch 5
[2. 1.] -3

```

```

1 import numpy as np
2 # for AND gate (Input/Output)
3 x_list = np.array([[0,0],[0,1],[1,0],[1,1]])
4 y_list = np.array([0,0,0,1])
5 epochs = 6
6 w,b = [1,2],-1
7 for _ in range(epochs):
8     for x,y in zip(x_list,y_list):
9         z = np.dot(x,w) + b
10         ### condition area for y_pred
11         y_pred = 1 if z >= 0 else 0
12         E = y - y_pred
13         print("error : ",E,"<- at epoch",_)
14         w += E*x
15         b += E
16     print(w,b)

```

```

error : 0 <- at epoch 0
[1 2] -1
error : -1 <- at epoch 0
[1 1] -2
error : 0 <- at epoch 0
[1 1] -2
error : 0 <- at epoch 0
[1 1] -2
error : 0 <- at epoch 1
[1 1] -2
error : 0 <- at epoch 1
[1 1] -2
error : 0 <- at epoch 1
[1 1] -2
error : 0 <- at epoch 1
[1 1] -2
error : 0 <- at epoch 2
[1 1] -2
error : 0 <- at epoch 2
[1 1] -2
error : 0 <- at epoch 2
[1 1] -2
error : 0 <- at epoch 2
[1 1] -2
error : 0 <- at epoch 3
[1 1] -2
error : 0 <- at epoch 3
[1 1] -2
error : 0 <- at epoch 3
[1 1] -2
error : 0 <- at epoch 3
[1 1] -2
error : 0 <- at epoch 4
[1 1] -2
error : 0 <- at epoch 4
[1 1] -2
error : 0 <- at epoch 4
[1 1] -2
error : 0 <- at epoch 4
[1 1] -2
error : 0 <- at epoch 5
[1 1] -2
error : 0 <- at epoch 5
[1 1] -2
error : 0 <- at epoch 5
[1 1] -2
error : 0 <- at epoch 5
[1 1] -2
error : 0 <- at epoch 5
[1 1] -2

```

```

1 import numpy as np
2 # for AND gate (Input/Output)
3 x_list = np.array([[0,0],[0,1],[1,0],[1,1]])
4 y_list = np.array([0,0,0,1])
5 epochs = 6
6 w,b = [1,2],-1
7 for _ in range(epochs):
8     total_error_in_epoch = 0
9     for x,y in zip(x_list,y_list):
10         z = np.dot(x,w) + b
11         ### condition area for y_pred
12         y_pred = 1 if z >= 0 else 0
13         E = y - y_pred
14         total_error_in_epoch += abs(E)
15         print("error : ",E,"<- at epoch",_)
16         w += E*x
17         b += E
18         print(w,b)
19 if total_error_in_epoch == 0:
20     print(f"Converged at epoch {_}. No errors found.")
21 break

```

```

error : 0 <- at epoch 0
[1 2] -1
error : -1 <- at epoch 0
[1 1] -2
error : 0 <- at epoch 0
[1 1] -2
error : 0 <- at epoch 0
[1 1] -2
error : 0 <- at epoch 1
[1 1] -2
error : 0 <- at epoch 1
[1 1] -2
error : 0 <- at epoch 1
[1 1] -2
error : 0 <- at epoch 1
[1 1] -2
error : 0 <- at epoch 1
[1 1] -2

```

Converged at epoch 1. No errors found.

```

1 # Changed y_list for OR gate
2
3 import numpy as np
4 # for OR gate (Input/Output)
5 x_list = np.array([[0,0],[0,1],[1,0],[1,1]])
6 y_list = np.array([0,1,1,1])
7 epochs = 6
8 w,b = [1,2],-1
9
10 for _ in range(epochs):
11     total_error_in_epoch = 0
12     for x,y in zip(x_list,y_list):
13         z = np.dot(x,w) + b
14         ### condition area for y_pred
15         y_pred = 1 if z >= 0 else 0
16         E = y - y_pred
17         total_error_in_epoch += abs(E)
18         print("error : ",E,"<- at epoch",_)
19         w += E*x
20         b += E
21         print(w,b)
22     if total_error_in_epoch == 0:
23         print(f"Converged at epoch {_}. No errors found.")
24         break

```

```

error :  0 <- at epoch 0
[1 2] -1
error :  0 <- at epoch 0
[1 2] -1
error :  0 <- at epoch 0
[1 2] -1
error :  0 <- at epoch 0
[1 2] -1
Converged at epoch 0. No errors found.

```

```

1 # Changed y_list for XOR gate
2 import numpy as np
3 # for XOR gate (Input/Output)
4 x_list = np.array([[0,0],[0,1],[1,0],[1,1]])
5 y_list = np.array([0,1,1,0])
6 epochs = 20
7 w,b = [1,2],-1
8 for _ in range(epochs):
9     total_error_in_epoch = 0
10    for x,y in zip(x_list,y_list):
11        z = np.dot(x,w) + b
12        ### condition area for y_pred
13        y_pred = 1 if z >= 0 else 0
14        E = y - y_pred
15        total_error_in_epoch += abs(E)
16        print("error : ",E,"<- at epoch",_)
17        w += E*x
18        b += E
19        print(w,b)
20    if total_error_in_epoch == 0:
21        print(f"Converged at epoch {_}. No errors found.")
22        break

```

```
error : -1 <- at epoch 15
[-1 0] 0
error : -1 <- at epoch 16
[-1 0] -1
error : 1 <- at epoch 16
[-1 1] 0
error : 1 <- at epoch 16
[0 1] 1
error : -1 <- at epoch 16
[-1 0] 0
error : -1 <- at epoch 17
[-1 0] -1
error : 1 <- at epoch 17
[-1 1] 0
error : 1 <- at epoch 17
[0 1] 1
error : -1 <- at epoch 17
[-1 0] 0
error : -1 <- at epoch 18
[-1 0] -1
error : 1 <- at epoch 18
[-1 1] 0
error : 1 <- at epoch 18
[0 1] 1
error : -1 <- at epoch 18
[-1 0] 0
error : -1 <- at epoch 19
[-1 0] -1
error : 1 <- at epoch 19
[-1 1] 0
error : 1 <- at epoch 19
[0 1] 1
error : -1 <- at epoch 19
[-1 0] 0
```