

Scilab Manual for
Neural Network
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Experiment: 1

Generate the activation functions-
Logistic, Hyperbolic, Identity
that are used in Neural
networks

Scilab code Solution 1.1 Activation functions in Neural network

```
1 //Illustrations of various activation functions used
   in Neural networks
2
3 x= -10:0.1:10;
4 tmp=exp(-x);
5 y1=1 ./ (1+tmp); //Logistic function
6 y2=(1-tmp) ./ (1+tmp); //Hyperbolic Tangent
   function
7 y3=x; //Identity function
8 subplot(2,3,1);
9 plot(x,y1);
```

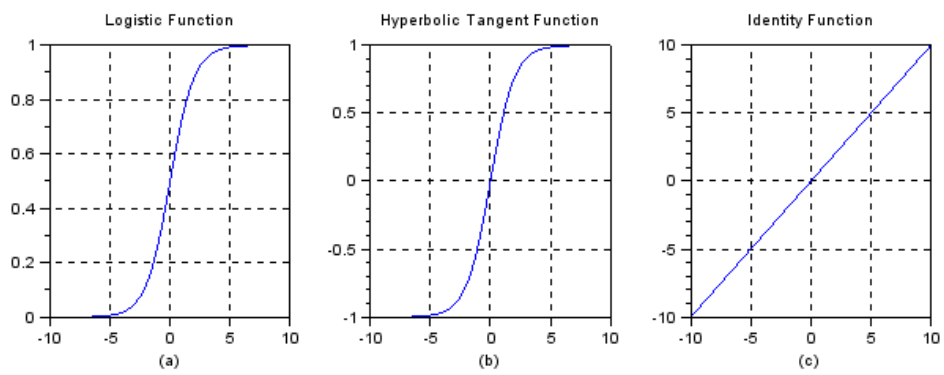


Figure 1.1: Activation functions in Neural network

```
10 set(gca(),"grid",[1 1]);
11 ([min(x) max(x) -2 2]);
12 title('Logistic Function');
13 xlabel('(a)');
14 ('square');
15 subplot(2,3,2);
16 plot(x,y2);
17 set(gca(),"grid",[1 1]);
18 ([min(x) max(x) -2 2]);
19 title('Hyperbolic Tangent Function');
20 xlabel('(b)');
21 ('square');
22 subplot(2,3,3);
23 plot(x,y3);
24 set(gca(),"grid",[1 1]);
25 ([min(x) max(x) -2 2]);
26 title('Identity Function');
27 xlabel('(c)');
28 ('square');
```

Experiment: 2

program for perceptron net for an AND function with bipolar inputs and targets

Scilab code Solution 2.1 Bipolar AND function

```
1 // Generate perceptron net for an AND function with
  bipolar inputs and targets
2 //      Truth table for AND gate
3 //      X1    X2    Y
4 //      -1    -1    -1
5 //      -1    1    -1
6 //      1    -1    -1
7 //      1    1    1          (Bipolar (1,-1))
8
9 clc;
10 clear;
11 x=[1 1 -1 -1;1 -1 1 -1]; //input
12 t=[1 -1 -1 -1]; //target
13 w=[0 0]; //Weights
14 b=0; //bias
15 alpha=input('Enter learning rate='); //learning
  rate
```

```

16 theta=input('Enter threshold value=');    //
    threshold value
17 con=1;
18 epoch=0;
19 while con
20     con=0;
21     for i=1:4
22         yin=b+x(1,i)*w(1)+x(2,i)*w(2);
23         if yin>theta then
24             y=1;
25         end
26         if yin<=theta & yin>= -(theta) then
27             y=0;
28         end
29         if yin<-(theta) then
30             y=-1;
31         end
32         if y-t(i) then
33             con=1;
34             for j=1:2
35                 w(j)=w(j)+alpha*t(i)*x(j,i);
36                 //upgrading of weight
37             end
38             b=b+alpha*t(i)           //upgrading of bias
39         end
40     end
41     epoch=epoch+1;
42     disp('perceptron for AND function');
43     disp('Final Weight matrix');
44     disp(w);
45     disp('Final Bias');
46     disp(b);

```

Experiment: 3

Generate Or function with bipolar inputs and targets using Adaline network

Scilab code Solution 3.1 Bipolar OR function

```
1 //Generate OR function with bipolar inputs and
  targets using Adaline network
2 //      Truth table for OR gate
3 //      X1      X2      Y
4 //      -1      -1      -1
5 //      -1      1       1
6 //      1       -1      1
7 //      1       1       1          (Bipolar (1,-1))
8
9
10 clc;
11 clear;
12 disp('Adaline network for OR function Bipolar inputs
  and targets');
13 //input pattern
14 x1=[1 1 -1 -1];
15 x2=[1 -1 1 -1];
```

```

16 //bias pattern
17 x3=[1 1 1 1];
18 //target vector
19 t=[1 1 1 -1];
20 //initial weights and bias
21 w1=0.1;w2=0.1;b=0.1;
22 //initialize learning rate
23 alpha=0.1;
24 //error convergence
25 e=2;
26 //change in weights and bias
27 delw1=0;delw2=0;delb=0;
28 epoch=0;
29 while(e>1.018)
30     epoch=epoch+1;
31     e=0;
32     for i=1:4
33         nety(i)=w1*x1(i)+w2*x2(i)+b;
34         //net input calculated and target
35         nt=[nety(i) t(i)];
36         delw1=alpha*(t(i)-nety(i))*x1(i);
37         delw2=alpha*(t(i)-nety(i))*x2(i);
38         delb=alpha*(t(i)-nety(i))*x3(i);
39         //weight changes
40         wc=[delw1 delw2 delb]
41         //updating of weights
42         w1=w1+delw1;
43         w2=w2+delw2;
44         b=b+delb;
45         //new weights
46         w=[w1 w2 b];
47         //input pattern
48         x=[x1(i) x2(i) x3(i)];
49         //printing the results obtained
50         disp([x nt wc w]);
51     end
52     for i=1:4
53         nety(i)=w1*x1(i)+w2*x2(i)+b;

```

```
54         e=e+(t(i)-nety(i))^2;  
55     end  
56     end
```

Experiment: 4

Generate XOR function for bipolar inputs and targets using Madaline network

Scilab code Solution 4.1 Bipolar XOR function

```
1 //Generate XOR function for bipolar inputs and
  targets using madaline network
2 //      Truth table for XOR gate
3 //      X1      X2      Y
4 //      -1      -1      -1
5 //      -1      1       1
6 //      1       -1      1
7 //      1       1       -1          (Bipolar (1,-1))
8
9
10 clc;
11 clear;
12 x=[1 1 -1 -1;1 -1 1 -1]; //input
13 t=[-1 1 1 -1]; //target
14 //assuming initial weight matrix and bias
15 w=[0.05 0.1;0.2 0.2];
16 b1=[0.3 0.15];
```

```

17 v=[0.5 0.5];
18 b2=0.5;
19 con=1;
20 alpha=0.5;
21 epoch=0;
22 while con
23     con=0;
24     for i=1:4
25         for j=1:2
26             zin(j)=b1(j)+x(1,i)*w(1,j)+x(2,i)*w(2,j)
27                 ;           //neural functin output
28             if zin(j)>=0 then
29                 z(j)=1;
30             else
31                 z(j)=-1;
32             end
33         end
34         yin=b2+z(1)*v(1)+z(2)*v(2);
35         if yin>=0 then
36             y=1;
37         else
38             y=-1;
39         end
40         if y~=t(i) then
41             con=1;
42             if t(i)==1 then
43                 if abs(zin(1))>abs(zin(2)) then
44                     k=2;
45                 else
46                     k=1;
47                 end
48                 b1(k)=b1(k)+alpha*(1-zin(k));
49                 //upgrading bias
50                 w(1:2,k)=w(1:2,k)+alpha*(1-zin(k))*x
51                     (1:2,i);           //upgrading weight
52             else
53                 for k=1:2
54                     if zin(k)>0 then

```

```

52         b1(k)=b1(k)+alpha*(-1-zin(k)
           );           //upgrading bias
53         w(1:2,k)=w(1:2,k)+alpha*(-1-
           zin(k))*x(1:2,i);           //
           upgrading weight
54         end
55     end
56     end
57     end
58     end
59     epoch=epoch+1;
60     end
61
62     disp('Weight matrix of hidden layer');
63     disp(w);
64     disp('Bias');
65     disp(b1);
66     disp('Total epoch');
67     disp(epoch);

```

Experiment: 5

Find the weight matrix of an auto associative net to store the vector(1 1 -1 -1).Test the response by presenting same pattern.

Scilab code Solution 5.1 Auto associative net

```
1 //Find the weight matrix of an Auto associative net
  to store the vector (1 1 -1 -1).Test the respnse
  of the network by presenting the same pattern and
  recognize whether it is a known vector or
  unknown vector
2 //Auto associative net has the same inputs and
  targets
3 clc;
4 clear;
5 x=[1 1 -1 -1]; //Given vector
6 w=zeros(4,4);
7 w=x'*x;
8 yin=x*w;
```

```
9 for i=1:4
10     if yin(i)>0 then
11         y(i)=1;
12     else
13         y(i)=-1;
14     end
15 end
16 disp('weight matrix');
17 disp(w);
18 if x==y then
19     disp('The vector is a known vector');
20 else
21     disp('The vector is unknown vector');
22 end
```

Experiment: 6

Find weight matrix in Bipolar form for BAM network on binary i/p o/p pairs

Scilab code Solution 6.1 BAM network

```
1 //Find the weight matrix in bipolar form for Bi-
   directional Associative Memory (BAM) network
   based on the following binary input output pairs
2 // s(1)=(1 1 0)      t(1)=(1 0)
3 // s(2)=(1 0 1)      t(2)=(0 1)
4
5 clc;
6 clear;
7 s=[1 1 0;1 0 1];      // s(1),s(2)
8 t=[1 0;0 1];        //t(1),t(2)
9 x=2*s-1;
10 y=2*t-1;
11 w=zeros(3,2);
12 for i=1:2
13     w=w+x(i,:)'*y(i,:);
14 end
15 disp('The calculated weight matrix');
```

16 `disp(w);`
