Homework 6 Solutions

1. Use the script file for the code on pg. 11, and modify it so that the weights come from using Widrow-Hoff. For the parameters, train it so that the learning rate is 0.2 with 500 iterations. Publish the result and turn it in.

   SOLUTION: Here is an example script-

```
X1=[1 2;1 1];
X2=[-1 0;2 2];
X3=[2 1;-1 -2];
X4=[-1 -2;-1 -2];
X=[X1 X2 X3 X4];

Y=[-1 -1 -1 -1 1 1 1 1
   -1 -1  1  1 -1 -1 1 1];
N=500;
a=0.05;
[W,b,err]=wid_hoff1(X',Y',a,N);

t=linspace(-3,3);
hold on
plot(X1(1,:),X1(2,:),'o',X2(1,:),X2(2,:),'x', ...
   X3(1,:),X3(2,:),'s',X4(1,:),X4(2,:),'p');

y1=-(W(1,1)/W(1,2))*t-b(1)/W(1,2);
y2=-(W(2,1)/W(2,2))*t-b(2)/W(2,2);
plot(t,y1,t,y2);
axis([-3 3 -3 3]);
```

2. Write a script file using the code from the previous pages to help, that will solve the exercise on page 13. Publish the result and turn it in.

   SOLUTION: Here is an example script:

```
X=[2 1 -2 -1;2 -2 2 1];
Y=[-1 1 -1 1];
lr=0.2;
iters=500;

[W,b,err]=wid_hoff1(X',Y',lr,iters);
t=linspace(-3,3);
y=-(W(1)/W(2))*t-(b/W(2));
hold on
class1=[1,3];  class2=[2,4];
plot(X(1,class1),X(2,class1),'go',X(1,class2),X(2,class2),'bo');
```

```
plot(t,y,'k-');
axis([-3 3 -3 3])
```

3. Write the solution to exercises 1 and 2, pg. 15:

   SOLUTION: We want to see that

$$e(k) = (t_k - y_k) = (t_k - (\mathbf{w}^T \mathbf{x}_k + b)) = t_k - (w_1 x_1^k + w_2 x_2^k + \ldots w_n x_n^k + b)$$

   and now we see that $\frac{\partial e(k)}{w_j} = -x_j$ and $\frac{\partial e(k)}{b} = -1$, and the rest follows from the chain rule.