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 ENEE434 HW5  
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Code

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```
function ecg

%////////////////////////////////////
% Problem 1

a(1) = -.4262;
a(2) = -.7032;
b(1) = 37.5915;
b(2) = 53.2531;
w(1) = .5996;
w(2) = .8903;
bias = 0.1048;
g(1) = 1.7730;
g(2) = 1.7721;

for t = 1:0.1:2
for i = 1:1:2
    x(i,t*10-9) = g(i)^(-1)*(t-b(i));
    out(i,t*10-9) = (2+a(i)^2)/(1+exp(-a(i)^2*x(i,t*10-9))+a(i)^2*exp(x(i,t*10-9)));
end
y(t*10-9) = w(1)*out(1,t*10-9) + w(2)*out(2,t*10-9) + bias;
end

disp('Outputs for the NN at times {1,2} in 0.1 increments')
probl = y'

%////////////////////////////////////
% Problem 2

d(1) = 0.06;
d(2) = 0.04;
t(1) = 1;
t(2) = 2;

n = 1;

for j = 1:1:2
    yold(j) = w(1)*f(x(1),a(1))+w(2)*f(x(2),a(2))+bias;
    e(j) = d(j)-yold(j);
    for (i=1:1:2)
        dEda(i) = -1*e(j)*w(i)*2*a(i)/(2+a(i)^2)*f(x(i),a(i))*(1-
f(x(i),a(i))*(exp(x(i))-x(i)*exp(-a(i)^2*x(i))));
        dEdgi(i) = 1*e(j)*w(i)*a(i)^2/(2+a(i)^2)*f(x(i),a(i))^2*(exp(x(i))-
x(i)*exp(-a(i)^2*x(i)))*(t(j)-b(i));
        dEdb(i) = -1*e(j)*(w(i)+w(2))-
a(i)^2/(2+a(i)^2)*f(x(i),a(i))^2*(exp(x(i))-x(i)*exp(-a(i)^2*x(i)))*g(i);
        dEdw(i) = -e(j)*f(x(i), a(i));
        dEdb(i) = -e(j);
    end
end
end
```

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        a(i) = a(i) - n*dEda(i);
        g(i) = g(i) - n*dEdgi(i);
        b(i) = b(i) - n*dEdb(i);
        w(i) = w(i) - n*dEdw(i);
        b(i) = b(i) - n*dEdb(i);
    end
    ynew(j) = w(1)*f(x(1),a(1))+w(2)*f(x(2),a(2))+bias;

end

disp('Outputs for the NN at times 1 and 2 after 1 iteration of training with
learning rate 1')
prob2 = ynew'

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
function out = f(x, a);

% Asymmetric Basis Function
out = (2+a^2)/(1+exp(-a^2*x)+a^2*exp(x));

```

## Runtime

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>> Outputs for the NN at times {1,2} in 0.1 increments

```

prob1 =

    0.1349
    0.1352
    0.1355
    0.1358
    0.1361
    0.1364
    0.1368
    0.1371
    0.1374
    0.1377
    0.1381

```

Outputs for the NN at times 1 and 2 after 1 iteration of training with learning rate 1

```

prob2 =

    0.1201
    0.1147

```