MLP Example
Version 0.1

Last Updated: January 22, 2012

MLP backpropagation example created by Morgan Bauer March 2011 for CAP6615

Verified by hayward cooper, joir-dan gumbs, sean goldberg

Most recent version most likely at http://www.cise.ufl.edu/ mhb/matlab/mlpexample.pdf or ask Dr. Wilson.

Soon to be on github.

currently only stochastic examples

```
varphi = @(x) 1.7159 * tanh ((2/3)*x);
varphiprime = @(x) 1.7159*(2/3)*(1-(tanh((2/3)*x).^2));
```

learning rate / eta /$\eta = 0.01$

momentum / alpha / $\alpha = 0$ (doesn't matter for first epoch however.)

sample data

Logical Input

```
x = [ 1   1
     -1   1
      1  -1
     -1  -1];
```

Exclusive Or (XOR) Output

```
d = [-1
       1
       1
      -1];
```

Suggested mode of checking:

1. Check in order as you implement. But, you aren't going to do that. So, instead.

2. Check the output weights of the first iteration over a single sample, if those are correct, everything is all right.

3. Otherwise, start with the forward-evaluation (v) intermediate values (i.e. before the activation function).

4. Then check the backprop values. (i.e. $\delta$s, then $\Delta$w, then w)

for comparison turn on printing extra precision. In Matlab, this is done with

```
format long g;
```

Network Structure
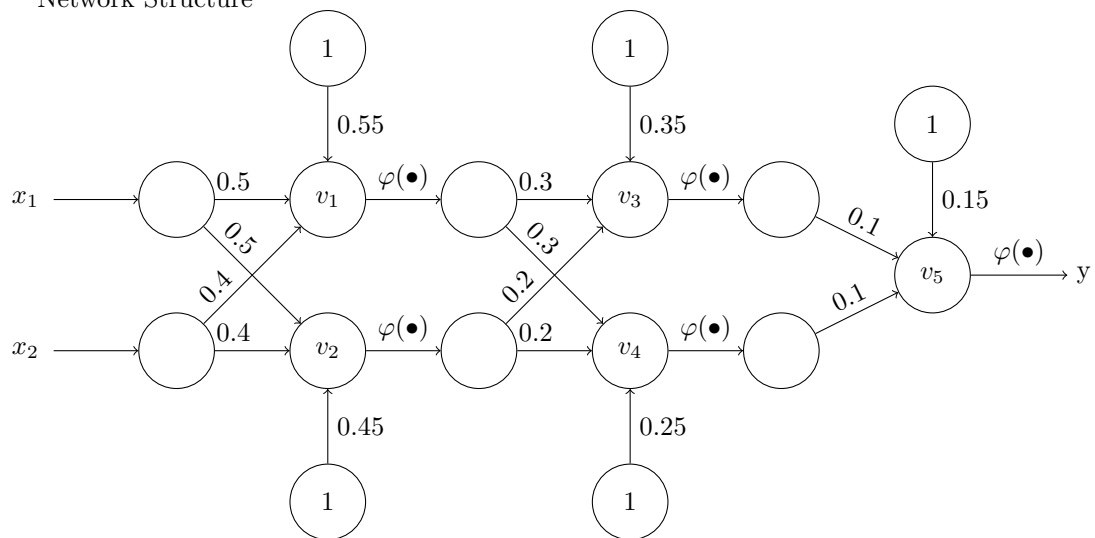
Matlab Dump Output, with all intermediate values
******* epoch 1 ******** stochastic/sequential/pattern mode Sample 1

```
current_X =
     1
     1
current_d =
    -1
```

Sample 1 Forward Evaluation

```
v12 =

                        1.45
                        1.35
v34 =
        0.980473686817253
        0.880473686817253
v5 =
        0.339065291500024
```

Sample 1 Backpropagation
remember these are calculated in the reverse order, so check the last value first

```
delta12 =
       -0.0362501820144165
       -0.0266444733664071
delta34 =
        -0.115196418011413
        -0.123981549053138
delta5  =
          -1.502153191989
```

Sample 1 Δw

```
dw12 =
     -0.000362501820144165
     -0.000266444733664071
     -0.000362501820144165
     -0.000266444733664071
dw34 =
      -0.00147702767388287
      -0.00158966903800957
      -0.00141587400776555
      -0.00152385165942794
dw5 =
       -0.0147982357061951
       -0.0136022674059141
```

4

Sample 1 Weight Updates

```
oldw =
                            0.5
                            0.5
                            0.4
                            0.4
neww =
            0.499637498179856
            0.499733555266336
            0.399637498179856
            0.399733555266336


oldw =
                            0.3
                            0.3
                            0.2
                            0.2
neww =
            0.298522972326117
             0.29841033096199
            0.198584125992234
            0.19847614834 0572


oldw =
                            0.1
                            0.1
neww =
            0.0852017642938049
            0.086397732594086
```

Sample 1 Bias Updates

```
newbias12 =
            0.549637498179856
            0.449733555266336
newbias34 =
            0.348848035819886
            0.248760184509469
newbias5 =
             0.13497846808011
```