Xihao Zhu COMP502 HW5

P1.

(1)

(a)

For own parameters, I use 0.12 as learn parameter, 1 as slope parameter, 10 hidden layers, 0.2 as momentum term constant, 20 as epoch size. Stopping criteria is “stop when 150,000 learning steps are performed”.

Initial weights are w =

Columns 1 through 7:

0.40000	0.10000	0.50000	-0.40000	0.50000	-0.90000	-0.80000
-0.30000	0.90000	0.60000	0.80000	-0.70000	0.20000	-0.40000

Columns 8 and 9:

-0.90000	1.00000
-0.10000	-0.40000

v =

-0.050000
0.300000
-0.300000
0.700000
0.700000
0.600000
-0.400000
0.700000
-0.600000
0.800000

(b)

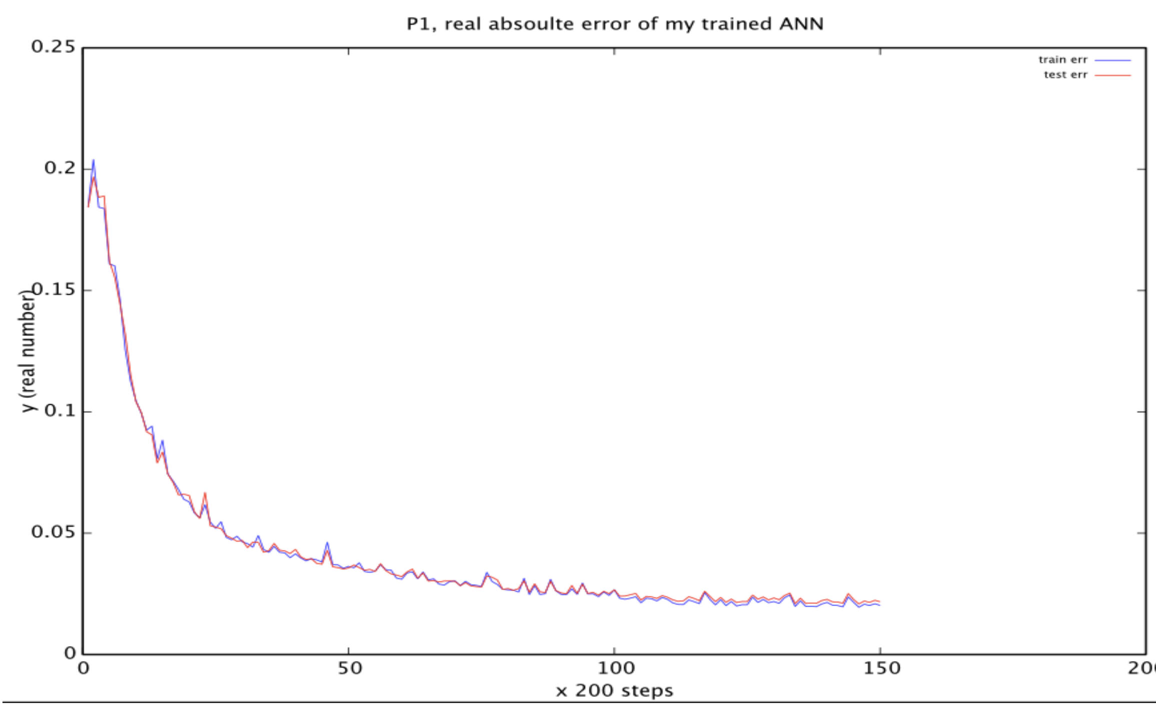
Learn step	Input vec		Desired	Actual	ek
10000	1	-0.43287	-0.471	-0.15428	-0.31672
20000	1	0.88708	-0.64456	-0.39194	-0.25262
30000	1	-0.82645	0.79887	0.72647	0.072402
40000	1	0.21186	-0.70298	-0.7276	0.024624
50000	1	0.012269	-0.9478	-0.79992	-0.14788
60000	1	0.020666	-0.94039	-0.80385	-0.13653
70000	1	-0.34321	-0.71574	-0.70555	-0.010198
80000	1	0.50266	-0.43696	-0.54967	0.11271
90000	1	0.71497	-0.49894	-0.47009	-0.028848
100000	1	0.77223	-0.54375	-0.51639	-0.027362
110000	1	0.043987	-0.91778	-0.85033	-0.067453
120000	1	0.16383	-0.7691	-0.75247	-0.016622
130000	1	-0.55097	-0.074666	-0.1077	0.033038
140000	1	-0.10421	-0.99997	-0.89701	-0.10296
150000	1	-0.68276	0.38922	0.46882	-0.079593

(c)

The error measurement is like this:

I use absolute error. The formula is to get sum of absolute value of every network's output minus desired output. Then scaling back the sum, so that the error is real error treating y as range of [-0.21, 1].

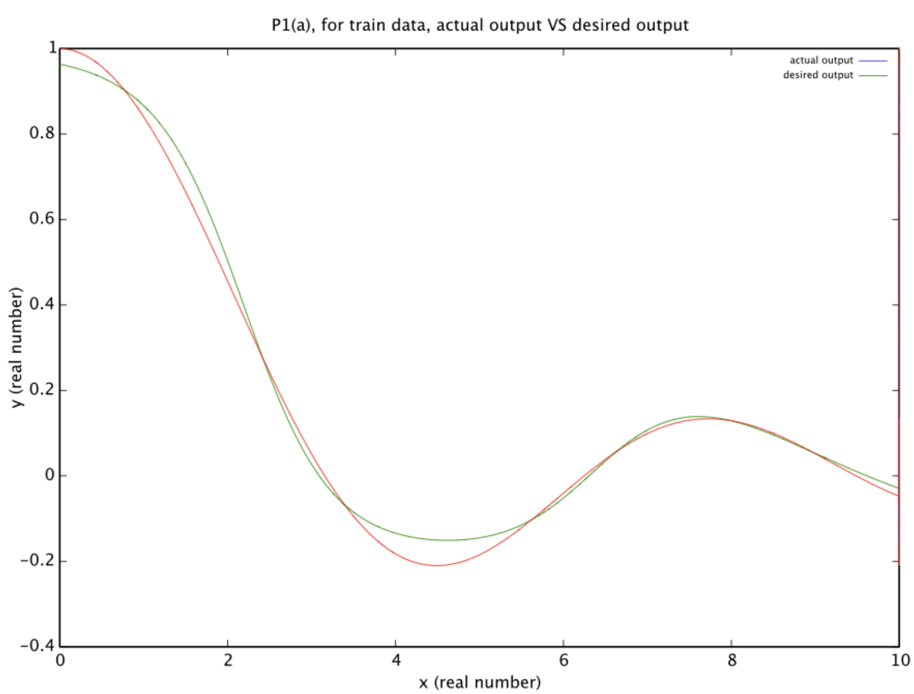
Here is the plot(y is absolute error)



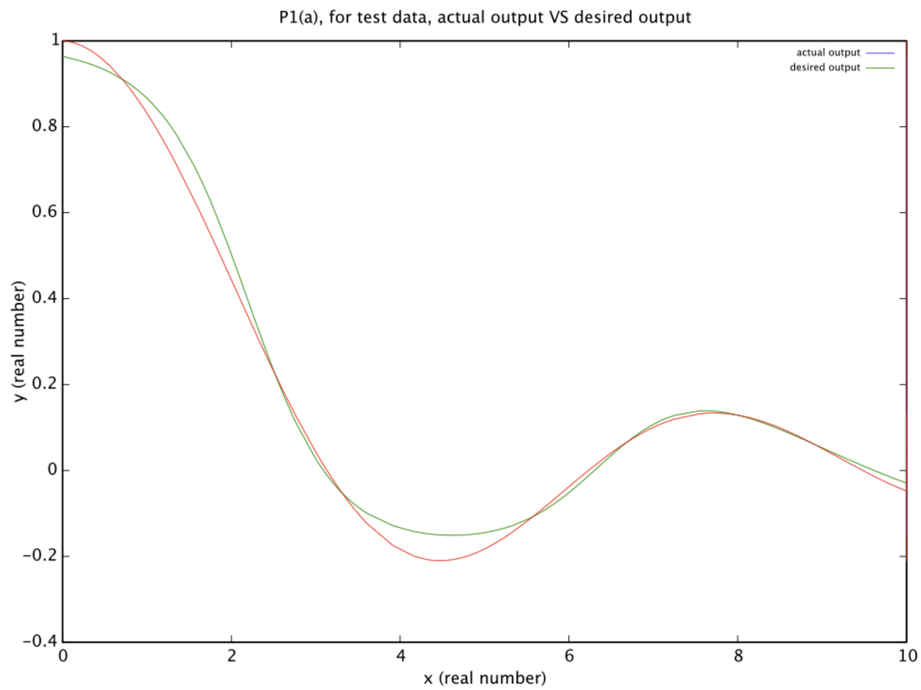
both the test error and train error are approaching 0.03. Therefore Error rate is about 0.03/(1-(-0.21))=2.48%

desired output VS calculated output is as follows(Matlab Color is wrong somehow, the red line is desired and green one is actual output)

For train data



For test data:



(2)
The code on owlspace doesn't work for me.(I am using Octave..) So what I did was that I wrote my own cross validation function.

P2
(1)
successful parameter sets
(a)
For my parameters, I use 0.08 as learn parameter, 1 as slope parameter, 8 hidden layers, 0.15 as momentum term constant, 20 as epoch size. Stopping criteria is "stop when 70,000 learning steps are performed". I run x from 1 to 40.
Initial weights are
w =

-2.40000	1.50000	0.30000	-0.30000	1.50000	1.20000	2.40000
0.30000	-1.80000	0.90000	-2.40000	2.70000	1.80000	1.80000

v =

2.40000
-2.40000
-0.30000
0.90000
0.30000
-0.30000
2.40000
1.80000

Yes, my initialized weights are big~

(b)

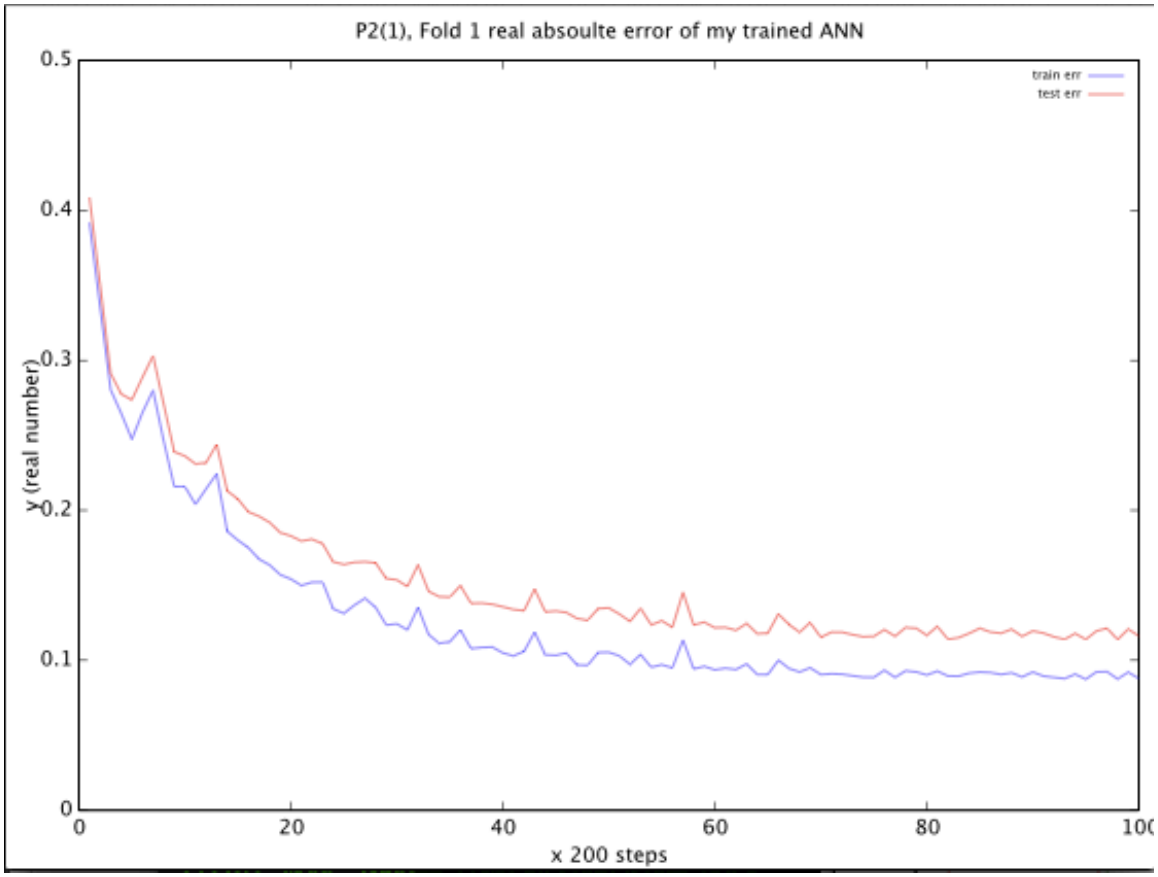
Learn step	Input vec		Desired	Actual	ek
6000	1	-0.052632	-0.30902	0.39015	-0.69917
12000	1	-0.15789	-0.80902	-0.48918	-0.31984
18000	1	0.052632	0.30902	0.39786	-0.088843
24000	1	-0.89474	0.80902	0.85527	-0.046252
30000	1	-0.26316	-1	-0.74219	-0.25781
36000	1	0.052632	0.30902	0.25875	0.050268
42000	1	-0.052632	-0.30902	-0.45773	0.14871
48000	1	-0.57895	0.30902	0.32889	-0.019874
54000	1	0.36842	0.80902	0.8231	-0.014081
60000	1	-0.26316	-1	-0.85871	-0.14129
66000	1	-0.68421	0.80902	0.727	0.08202

(c)

The error measurement is like this:

I use absolute error. The formula is to get sum of absolute value of every network's output minus desired output. Then scaling back the sum, so that the error is real error treating y as range of [-1, 1].

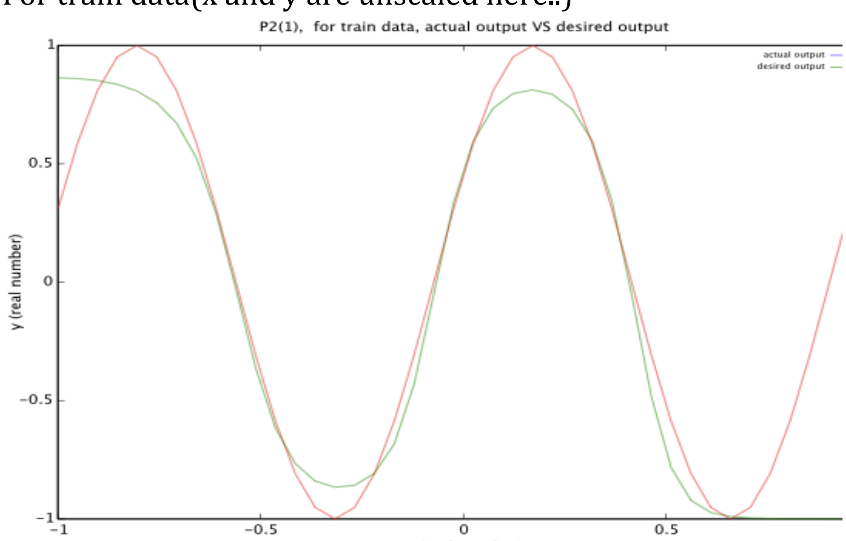
Here is the plot(y is absolute error)



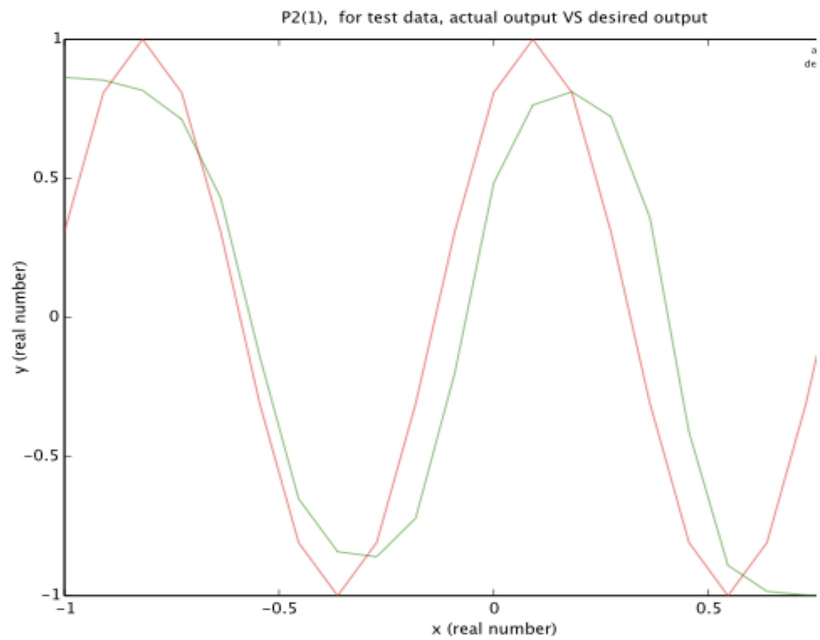
both the test error and train error are approaching 0.1. Therefore Error rate is about 0.1/(1-(-1))=5%

desired output VS calculated output is as follows(Matlab Color is wrong somehow, the red line is desired and green one is actual output)

For train data(x and y are unscaled here..)



For test data(x and y are unscaled here).



Unsuccessful parameter sets

(a)

For this set of parameters, I use 0.01 as learn parameter, 1 as slope parameter, 80 hidden layers, 0.1 as momentum term constant, 200 as epoch size. Stopping criteria is “stop when 70,000 learning steps are performed”. I run x from 1 to 40.

Initial weights are

w =

Columns 1 through 6:

0.200000	-0.900000	-0.400000	0.400000	0.500000	0.050000
0.800000	-0.900000	-0.500000	0.300000	-0.700000	-0.500000

Column 7:

0.600000
0.400000

v =

0.90000
-0.80000
0.50000
0.40000
-0.40000
-0.70000
0.70000
-0.60000

(b)

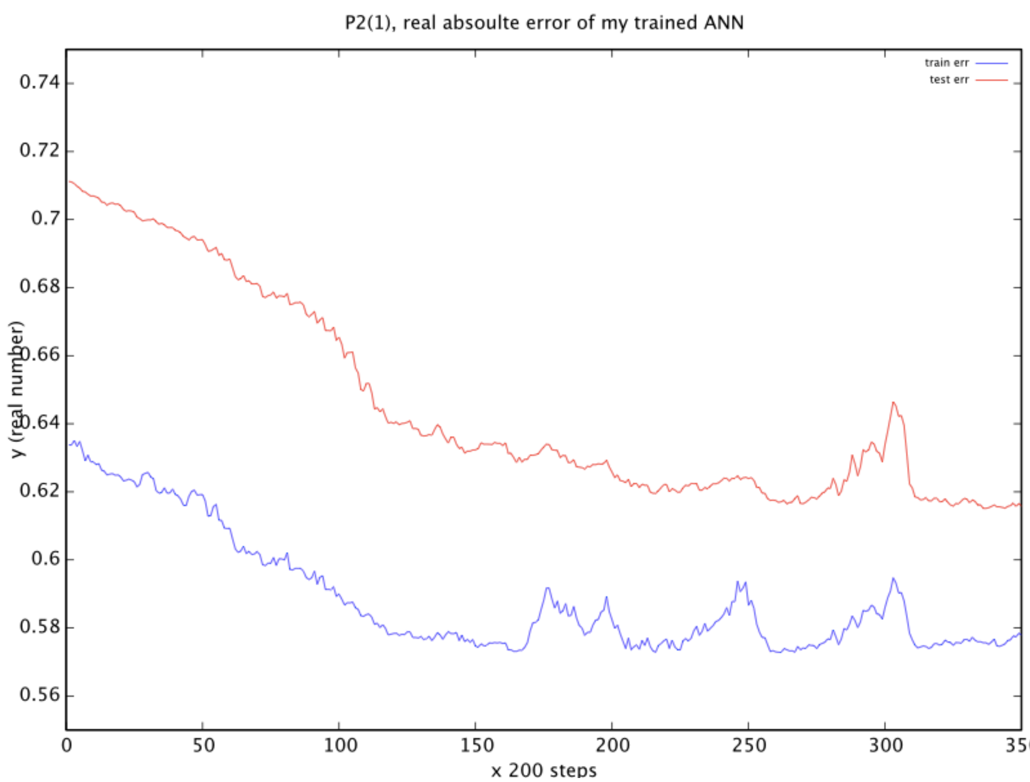
Learn step	Input vec		Desired	Actual	ek
6000	1	0.70732	-0.95106	-0.79142	-0.15963
12000	1	-0.70732	0.80902	0.44589	0.36313
18000	1	-0.41463	-0.80902	0.13622	-0.94523
24000	1	-0.41463	-0.80902	0.28218	-1.0912
30000	1	-0.36585	-0.95106	0.24687	-1.1979
36000	1	1	0.58779	-0.17167	0.75946
42000	1	-0.5122	-0.30902	0.3015	-0.61051
48000	1	-0.85366	0.95106	0.55124	0.39982
54000	1	-0.17073	-0.58779	0.025544	-0.61333
60000	1	-0.31707	-1	-0.092608	-0.90739
66000	1	0.90244	-4.4409e-16	-0.25086	0.25086

(c)

The error measurement is like this:

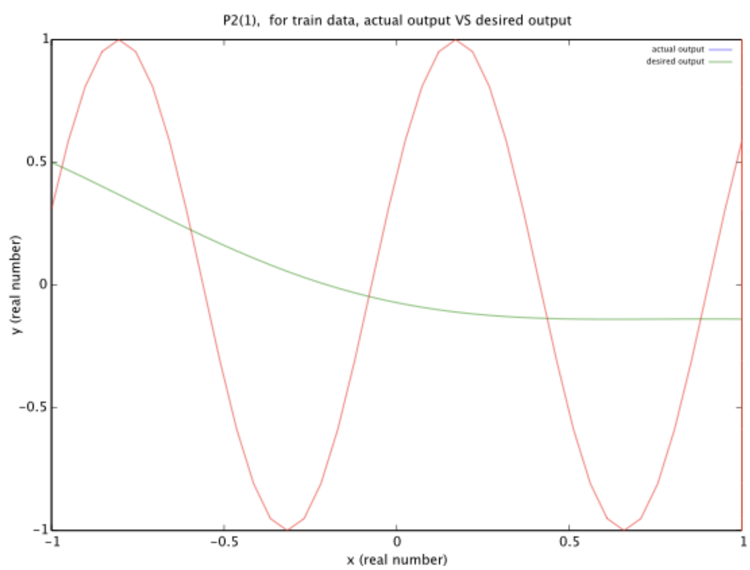
I use absolute error. The formula is to get sum of absolute value of every network's output minus desired output. Then scaling back the sum, so that the error is real error treating y as range of [-1, 1].

Here is the plot(y is absolute error)

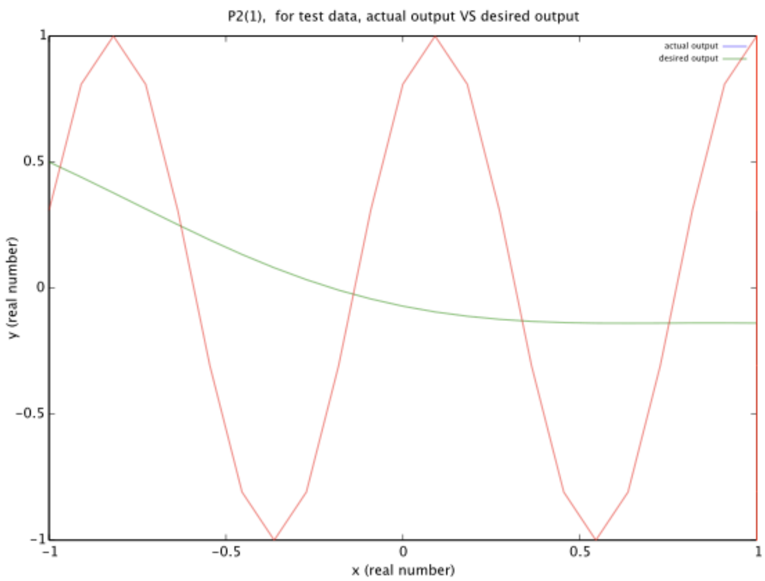


test error is nearly 0.64, train error is about 0.58. This result is really sad…

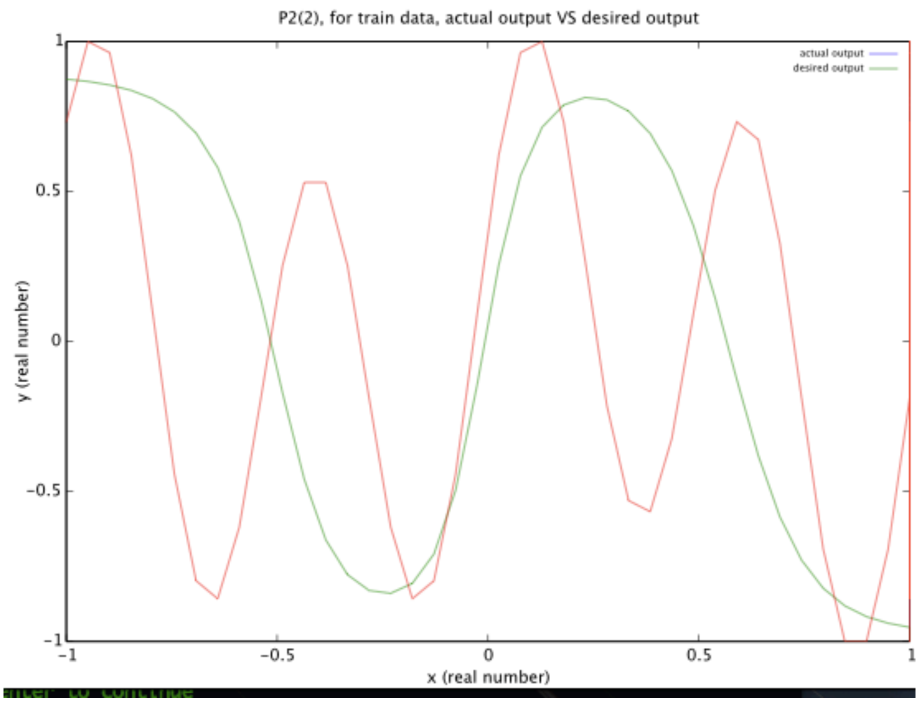
desired output VS calculated output is as follows(Matlab Color is wrong somehow, the red line is desired and green one is actual output)
For train data(x and y are unscaled here..)



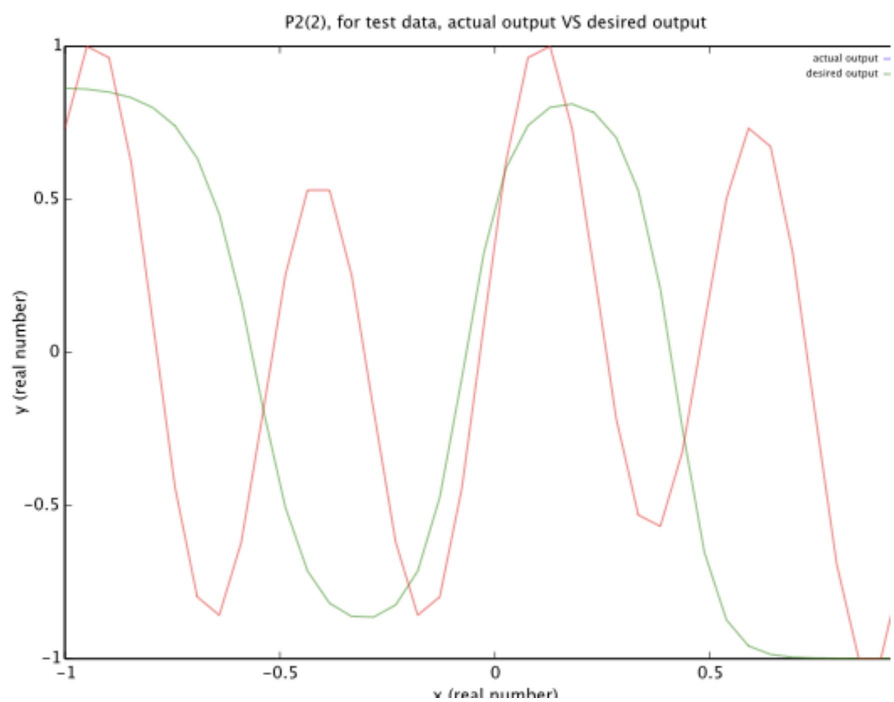
for test data:



P2
(2)
Unscaled actual output VS desired output is shown here
For train set:



for test data:



Seems that the green line(actual output) actually find out the sine sector(s(nT)) of the red line which represent the whole equation(Z(nT))

P3.

(a)

For my parameters, I use 0.05 as learn parameter, 1 as slope parameter, 10 hidden layers, 0.9 as momentum term constant, 200 as epoch size. Stopping criteria is "stop when 100,000 learning steps are performed".

Initial weights are

w =

Columns 1 through 6:

0.080000	0.200000	-0.060000	-0.010000	0.160000	-0.160000
-0.100000	0.060000	-0.120000	0.040000	-0.140000	0.020000
0.200000	0.160000	-0.120000	-0.140000	0.020000	0.120000
0.140000	-0.020000	0.060000	0.160000	-0.020000	0.060000
0.100000	-0.140000	-0.060000	-0.040000	-0.100000	0.040000

Columns 7 through 9:

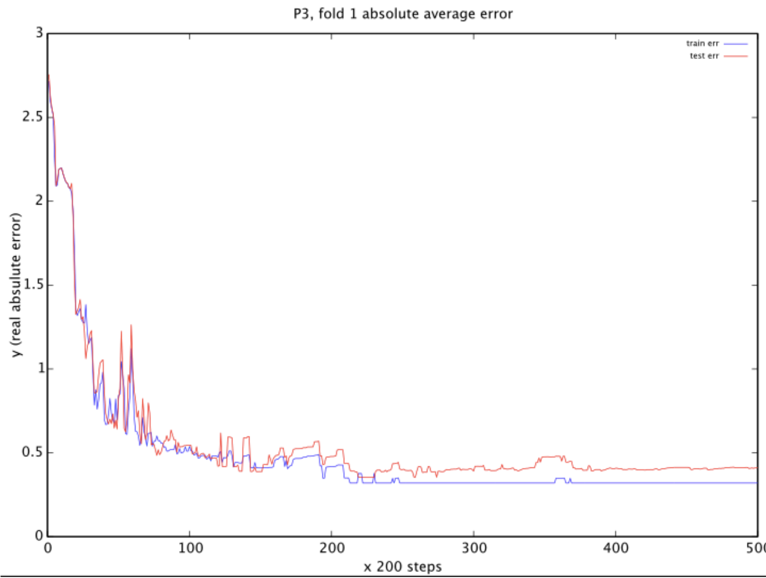
-0.120000	-0.040000	0.020000
0.180000	-0.080000	-0.010000
-0.040000	-0.060000	-0.060000
-0.140000	-0.060000	0.080000
0.140000	-0.060000	-0.020000

v =

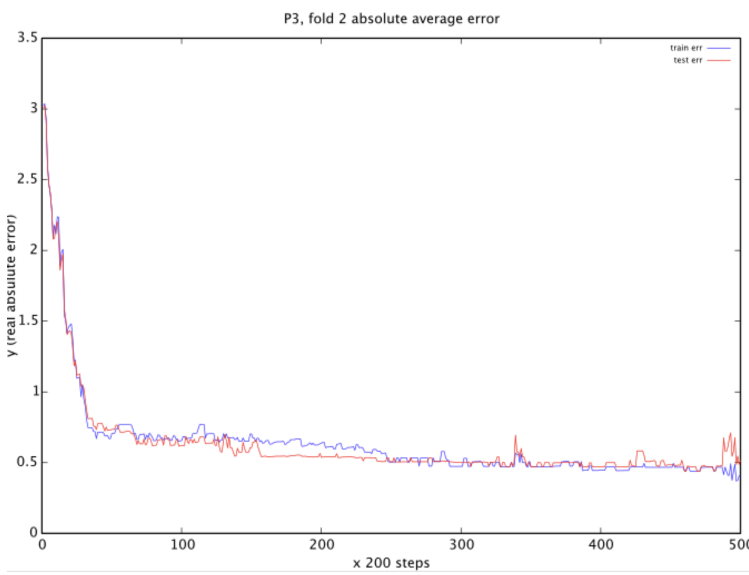
0.080000	0.080000	0.200000
0.180000	0.020000	-0.080000
0.080000	0.020000	-0.100000
0.160000	-0.040000	0.160000
0.080000	0.200000	0.060000
0.140000	-0.140000	0.100000
-0.120000	-0.100000	-0.040000
-0.140000	-0.180000	-0.020000
0.160000	-0.180000	-0.100000
-0.040000	-0.100000	-0.120000

(b)&(c)

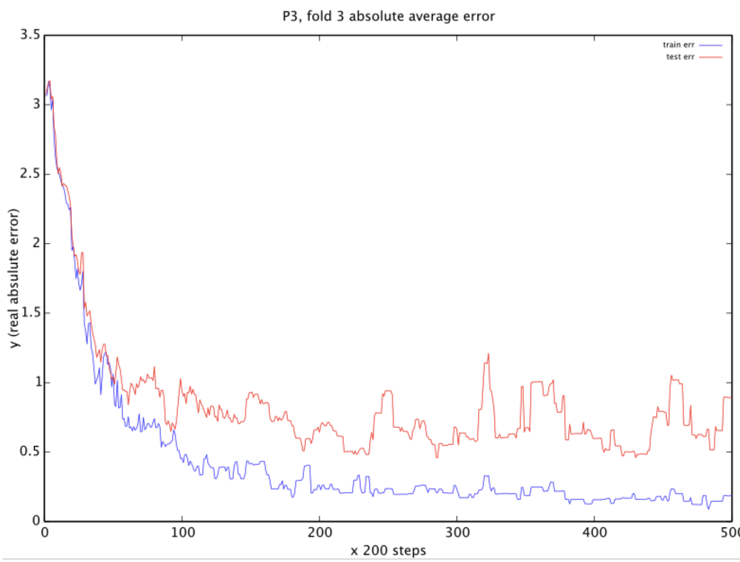
fold 1:



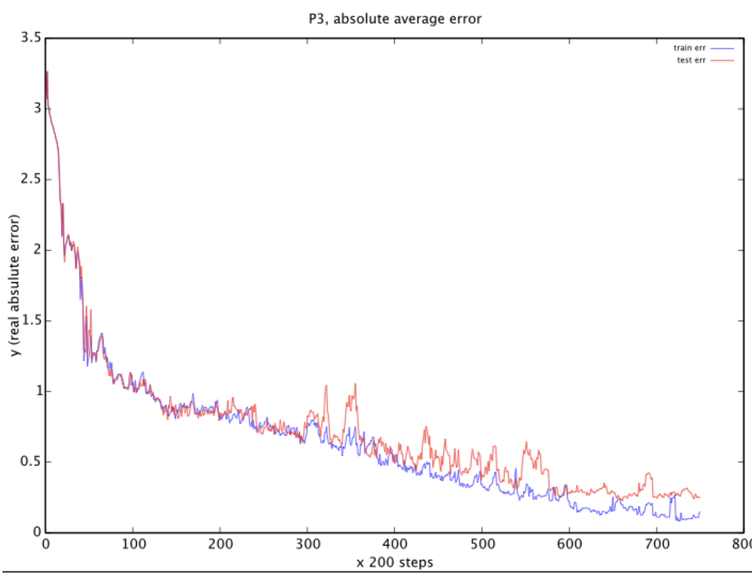
fold 2:



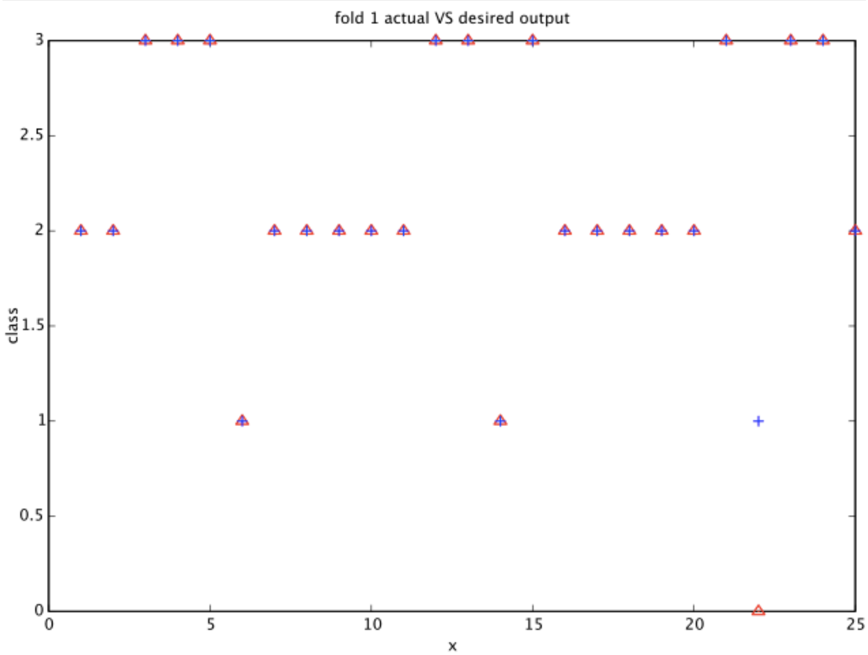
fold 3:



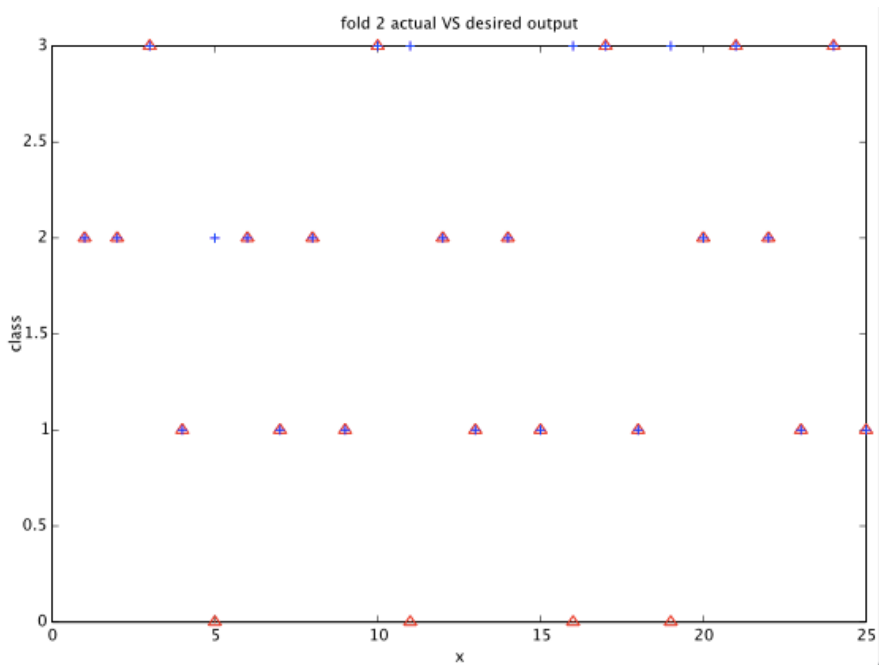
the following is using all test and train data:



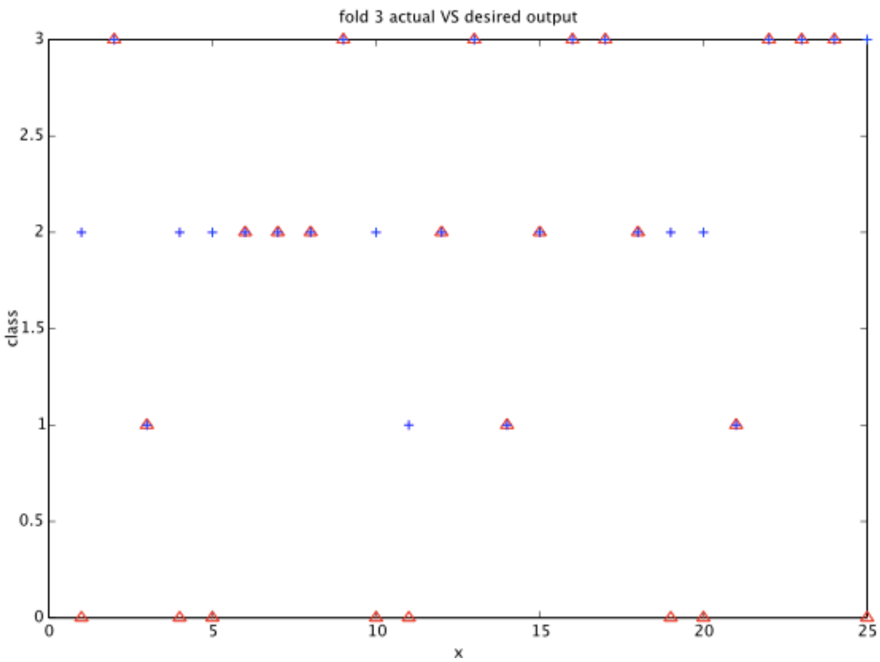
Below I am plotting out Desired output VS actual output for 3 folds:
I forgot to add legends. + is desired output. Triangle is actual output.
For y value,
1 is [1,0, 0] meaning Setosa
2 is [0 1 0] meaning Versacolor
3 is [0 0 1] meaning Virginica
Fold 1:



fold 2:



fold3:



I think this plots are reasonable because fold 3 has high error rate, which we can tell also from its actual VS desired output~ Others are fine~