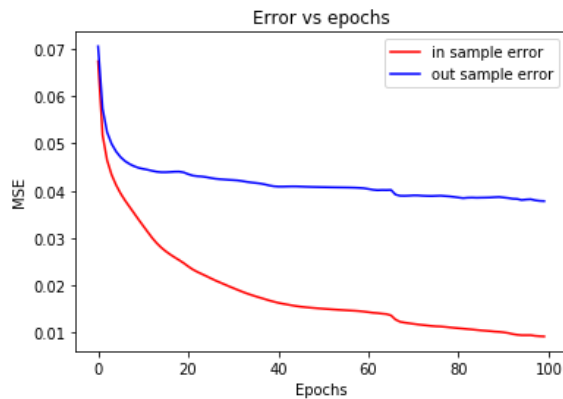


# Report

## Using Sigmoid Activation Function

1. In this case the optimum number of epochs(full data forward and backward) is **20**
2. The Best prediction occurred when threshold was set to **0.5** (measured in case of 100 epochs)
3. Error % = 5.9192825112107625
4. The In sample and out sample error can be seen by running the make file



### Errors for the 20 epochs

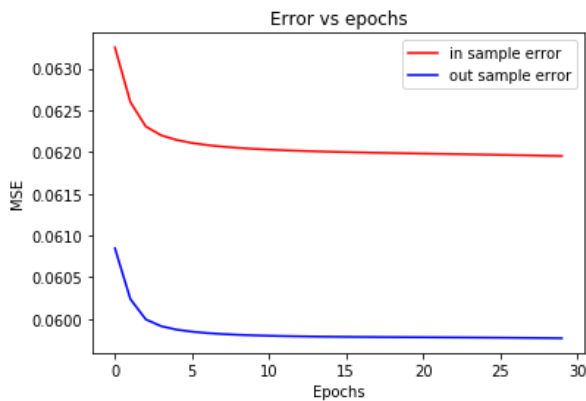
1. epoch = 0 in sample error = [[0.07000685]] out sample error = [[0.06887838]]
2. epoch = 1 in sample error = [[0.04967488]] out sample error = [[0.05188528]]
3. epoch = 2 in sample error = [[0.0433781]] out sample error = [[0.04900305]]
4. epoch = 3 in sample error = [[0.03938936]] out sample error = [[0.04811256]]
5. epoch = 4 in sample error = [[0.03646648]] out sample error = [[0.04722918]]
6. epoch = 5 in sample error = [[0.03453045]] out sample error = [[0.04652785]]
7. epoch = 6 in sample error = [[0.03302328]] out sample error = [[0.04578363]]
8. epoch = 7 in sample error = [[0.03166194]] out sample error = [[0.04501566]]
9. epoch = 8 in sample error = [[0.03040933]] out sample error = [[0.04438985]]
10. epoch = 9 in sample error = [[0.02917454]] out sample error = [[0.04382423]]
11. epoch = 10 in sample error = [[0.02805622]] out sample error = [[0.04323449]]
12. epoch = 11 in sample error = [[0.02712003]] out sample error = [[0.04272627]]
13. epoch = 12 in sample error = [[0.02623825]] out sample error = [[0.04242624]]
14. epoch = 13 in sample error = [[0.02539557]] out sample error = [[0.04226404]]
15. epoch = 14 in sample error = [[0.02463995]] out sample error = [[0.04207136]]
16. epoch = 15 in sample error = [[0.0239527]] out sample error = [[0.04184823]]
17. epoch = 16 in sample error = [[0.02335448]] out sample error = [[0.04169565]]
18. epoch = 17 in sample error = [[0.02288708]] out sample error = [[0.04173591]]
19. epoch = 18 in sample error = [[0.0225774]] out sample error = [[0.04204827]]
20. epoch = 19 in sample error = [[0.02244757]] out sample error = [[0.04264952]]

## Using tanh Activation Function

1. In this case the optimum number of epochs(full data backward forward and backward) is **10**
2. The Best prediction occurred when threshold was set to **0.5** (measured in case of 100 epochs)

3. Error % = 13.004484304932735

4. The In sample and out sample error can be seen by running the make file



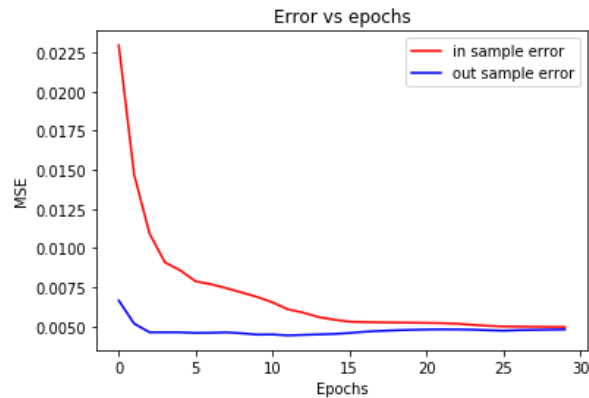
### Errors for the 20 epochs

1. epoch = 0 in sample error = [[0.06331788]] out sample error = [[0.06091859]]
2. epoch = 1 in sample error = [[0.06306938]] out sample error = [[0.06071606]]
3. epoch = 2 in sample error = [[0.06266255]] out sample error = [[0.06040885]]
4. epoch = 3 in sample error = [[0.06244742]] out sample error = [[0.06025909]]
5. epoch = 4 in sample error = [[0.0623313]] out sample error = [[0.06018341]]
6. epoch = 5 in sample error = [[0.06225841]] out sample error = [[0.06013876]]
7. epoch = 6 in sample error = [[0.06220807]] out sample error = [[0.06010975]]
8. epoch = 7 in sample error = [[0.06217122]] out sample error = [[0.0600898]]
9. epoch = 8 in sample error = [[0.06214322]] out sample error = [[0.06007557]]
10. epoch = 9 in sample error = [[0.0621214]] out sample error = [[0.06006521]]
11. epoch = 10 in sample error = [[0.06210408]] out sample error = [[0.06005757]]
12. epoch = 11 in sample error = [[0.06209013]] out sample error = [[0.06005193]]
13. epoch = 12 in sample error = [[0.06207878]] out sample error = [[0.06004778]]
14. epoch = 13 in sample error = [[0.06206948]] out sample error = [[0.06004479]]
15. epoch = 14 in sample error = [[0.06206179]] out sample error = [[0.06004269]]
16. epoch = 15 in sample error = [[0.06205542]] out sample error = [[0.06004131]]
17. epoch = 16 in sample error = [[0.06205011]] out sample error = [[0.06004049]]
18. epoch = 17 in sample error = [[0.06204568]] out sample error = [[0.06004014]]
19. epoch = 18 in sample error = [[0.06204197]] out sample error = [[0.06004016]]
20. epoch = 19 in sample error = [[0.06203886]] out sample error = [[0.06004049]]

### Using Softmax(outer layer) with sigmoid Activation(Inner layers) Function

1. In this case the optimum number of epochs(full data forward and backward) is **10**
2. Error % = 2.7213

3. The In sample and out sample error can be seen by running the make file



### Errors for the 10 epochs

1. epoch = 0 in sample error = 0.02273503858122315 out sample error = 0.007162171777874137
2. epoch = 1 in sample error = 0.019039057070887967 out sample error = 0.00676928273784265
3. epoch = 2 in sample error = 0.01229532499222846 out sample error = 0.005518591875717087
4. epoch = 3 in sample error = 0.010436962804613672 out sample error = 0.00527586169769197
5. epoch = 4 in sample error = 0.009079299095739263 out sample error = 0.005025174929672762
6. epoch = 5 in sample error = 0.00788140072824894 out sample error = 0.005070509816121577
7. epoch = 6 in sample error = 0.007592482713845407 out sample error = 0.0053265288872952
8. epoch = 7 in sample error = 0.006985471072299583 out sample error = 0.005331678164589855
9. epoch = 8 in sample error = 0.006868248685164497 out sample error = 0.005408787272347877
10. epoch = 9 in sample error = 0.006621877653349465 out sample error = 0.005462101616049393

**The best architecture is softmax(outer layer) with sigmoid(inner layers) ran for 10 epochs with has only 2.7213% error rate in prediction**

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**Submitted by :**

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