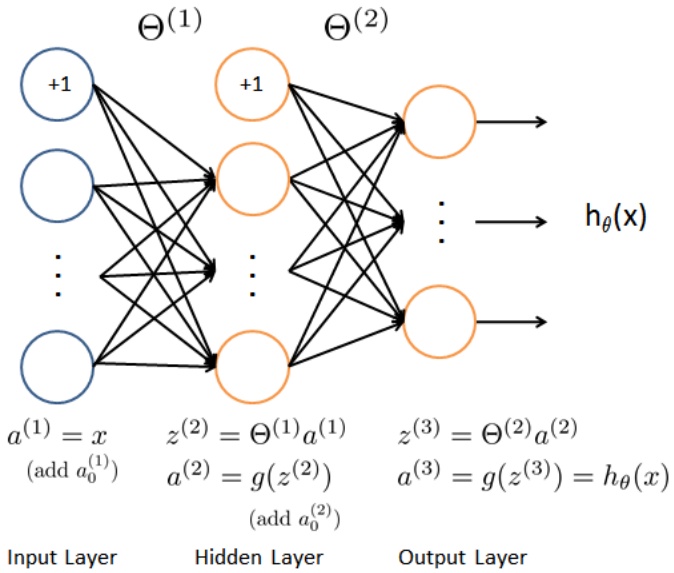
HW5 Report

Zhongze Tang (zt67)

Q1 Neural Network

I add a bias unit to the input layer and the hidden layer respectively. So the network looks like:



Note that sometimes the program won't give you the result because the weights (theta1 and theta2) are initialized randomly, which may cause the cost function J won't converge.

You can change the learning_rate and target_error in Line 97 and 98.

Results

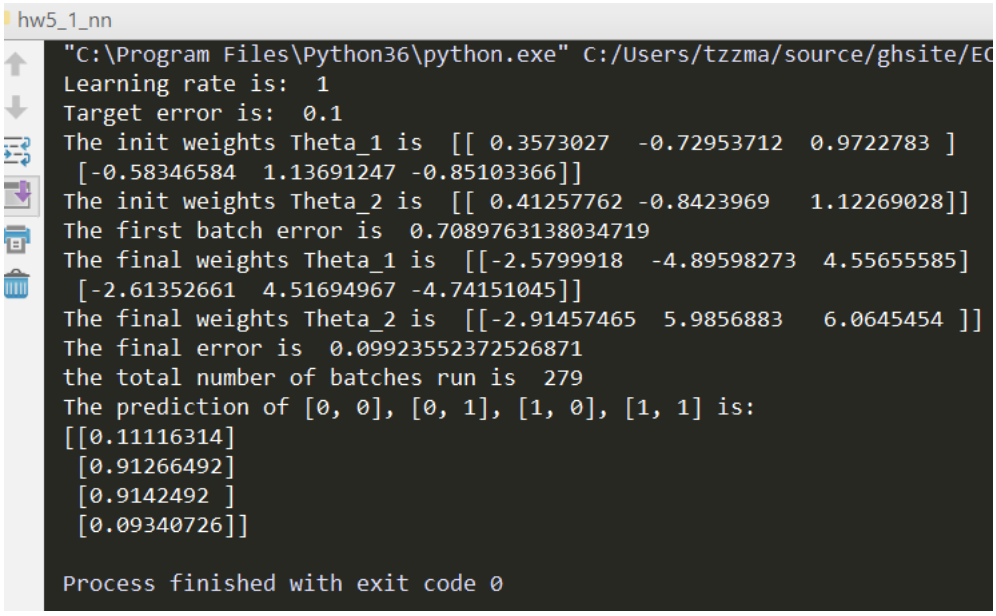
Learning rate is: 0.5

Target error is: 0.1

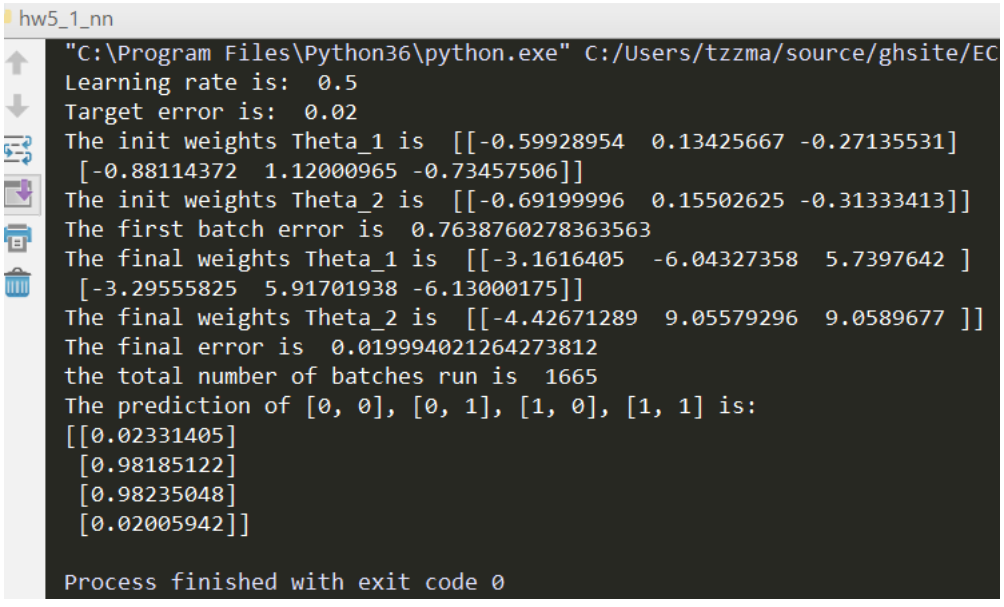
```
hw5_1_nn
"C:\Program Files\Python36\python.exe" C:/Users/tzzma/source/ghsite/ECE
Learning rate is:  0.5
Target error is:  0.1
The init weights Theta_1 is  [[-0.70448519  0.34962265 -0.00183366]
 [-0.42859289  0.77025037 -0.33904636]]
The init weights Theta_2 is  [[-0.81346943  0.40370946 -0.00211733]]
The first batch error is  0.7473887431733525
The final weights Theta_1 is  [[-2.48518389 -4.75741324  4.44052302]
 [-2.7905454   4.75670488 -4.97117611]]
The final weights Theta_2 is  [[-2.87972984  5.87076914  6.06534585]]
The final error is  0.09984352710240205
the total number of batches run is  1235
The prediction of [0, 0], [0, 1], [1, 0], [1, 1] is:
[[0.11130846]
 [0.90600535]
 [0.92019333]
 [0.09469871]]

Process finished with exit code 0
```

Learning rate is: 1
Target error is: 0.1



Learning rate is: 0.5
Target error is: 0.02



Learning rate is: 1
Target error is: 0.02

```
v5_1_nn
"C:\Program Files\Python36\python.exe" C:/Users/tzzma/source/ghsite/EC
Learning rate is:  1
Target error is:  0.02
The init weights Theta_1 is  [[ 1.0694485  -1.09761838  0.77473512]
 [-1.18344097 -0.37105313 -1.15591441]]
The init weights Theta_2 is  [[ 1.23489276 -1.26742053  0.89458706]]
The first batch error is  0.7193901853146311
The final weights Theta_1 is  [[-3.1922012  -6.07946469  5.7804769 ]
 [-3.18382444  5.72210939 -5.95227636]]
The final weights Theta_2 is  [[-4.45401687  9.09426867  9.12495069]]
The final error is  0.019985777758202344
the total number of batches run is  880
The prediction of [0, 0], [0, 1], [1, 0], [1, 1] is:
[[0.02338099]
 [0.98211198]
 [0.98207873]
 [0.01994904]]

Process finished with exit code 0
```

Learning rate in [0.05, 0.1, 0.3, 0.5, 0.75, 1]
The init weights Theta_1 is [[-0.38404047 -0.06897211 1.12252285]
 [0.99525219 -0.78971388 0.35975224]]
The init weights Theta_2 is [[-0.44345173 -0.07964214 1.29617774]]

Learning rate is: 0.05
Target error is: 0.1
The first batch error is 0.7174708075735095
The final weights Theta_1 is [[-2.27973707 5.47942452 5.48520361]
 [6.06182938 -4.05718349 -4.05844979]]
The final weights Theta_2 is [[-8.85899284 6.16701676 6.06162017]]
The final error is 0.09998439355685633
the total number of batches run is 12035

Learning rate is: 0.1
Target error is: 0.1
The first batch error is 0.7174708075735095
The final weights Theta_1 is [[-2.27984016 5.47958173 5.4853568]
 [6.06207454 -4.05734265 -4.05860811]]
The final weights Theta_2 is [[-8.85945217 6.16729371 6.06195859]]
The final error is 0.09996820523917618
the total number of batches run is 6019

Learning rate is: 0.3
Target error is: 0.1
The first batch error is 0.7174708075735095
The final weights Theta_1 is [[-2.27994594 5.4797204 5.4854824]
[6.06225125 -4.05745214 -4.05871494]]
The final weights Theta_2 is [[-8.85998035 6.16759386 6.06237466]]
The final error is 0.09995153130685704
the total number of batches run is 2008

Learning rate is: 0.5
Target error is: 0.1
The first batch error is 0.7174708075735095
The final weights Theta_1 is [[-2.28032037 5.48028715 5.48603387]
[6.06313856 -4.05802736 -4.05928699]]
The final weights Theta_2 is [[-8.86165711 6.16860239 6.0636132]]
The final error is 0.09989264894379402
the total number of batches run is 1206

Learning rate is: 0.75
Target error is: 0.1
The first batch error is 0.7174708075735095
The final weights Theta_1 is [[-2.28074798 5.4809295 5.48665797]
[6.06414795 -4.05868079 -4.05993664]]
The final weights Theta_2 is [[-8.86358181 6.16975724 6.06503851]]
The final error is 0.09982531382072798
the total number of batches run is 805

Learning rate is: 1
Target error is: 0.1
The first batch error is 0.7174708075735095
The final weights Theta_1 is [[-2.27965468 5.47914069 5.4848656]
[6.06116554 -4.05671692 -4.05797233]]
The final weights Theta_2 is [[-8.85901294 6.16690594 6.06181359]]
The final error is 0.09999633955642356
the total number of batches run is 604

We can safely conclude that 1 is the best choice for learning rate because the total number of running times of it is the least.

Q2 A Web Page

Just designed as the homework required, but more details. For example, the table will reset itself when the shape, radius or height changes, and the height input textbox will be disabled when the user chooses sphere.