Min Ho Lee
903122265
mlee432@gatech.edu

Question 5: Learning With Restarts
testPenData:
max: 0.910234419668
average: 0.902172670097
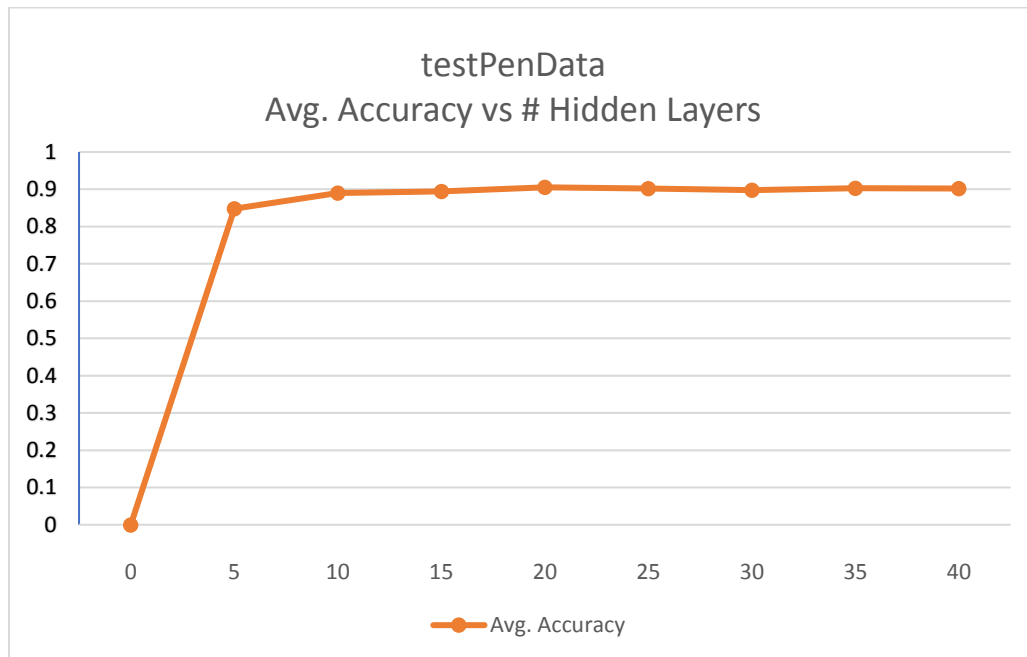standard deviation: 0.00712839216719

testCarData:
max: 0.861256544503
average: 0.841753926702
standard deviation: 0.013202388491
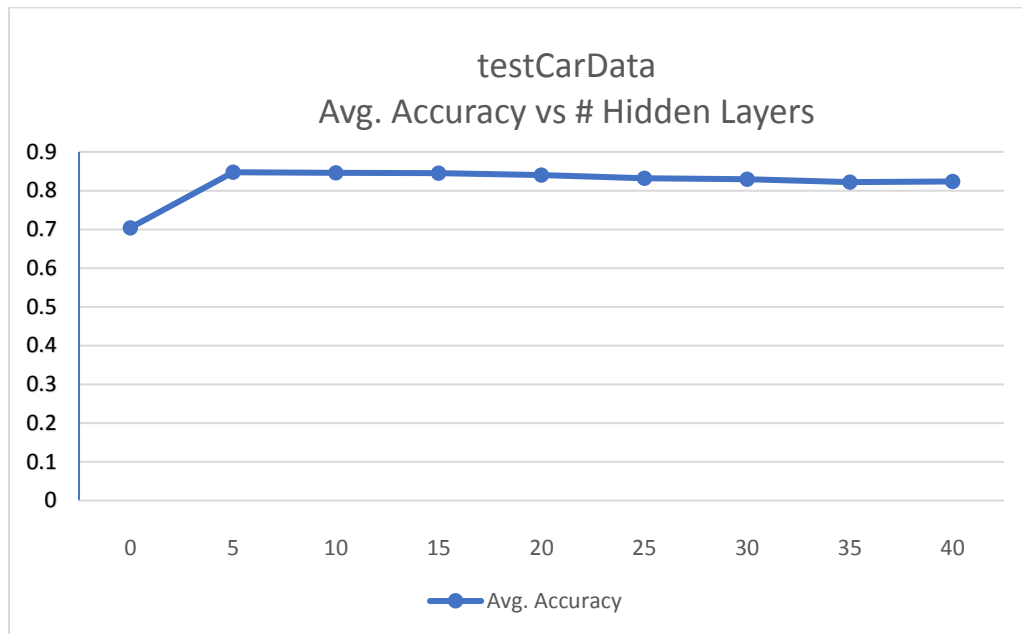
Question 6: Varying The Hidden Layer
testPenData:

| # Hidden | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 |
|---|---|---|---|---|---|---|---|---|---|
| MAX | 0 | 0.857918811 | 0.896512293 | 0.903659234 | 0.909090909 | 0.906232133 | 0.9053745 | 0.9053745 | 0.905088622 |
| AVG | 0 | 0.848313322 | 0.890108634 | 0.893996569 | 0.905260149 | 0.902287021 | 0.897998856 | 0.902973128 | 0.902001144 |
| STD | 0 | 0.006264831 | 0.005334817 | 0.00828631 | 0.004129324 | 0.003291444 | 0.007340768 | 0.00200196 | 0.001925381 |



testPenData
Avg. Accuracy vs # Hidden Layers

Increasing the number of hidden layer initially increases the average accuracy, but it plateaus after 5. The max is very close to the average accuracy value.

testCarData:

| # Hidden | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 |
|---|---|---|---|---|---|---|---|---|---|
| MAX | 0.704188482 | 0.87565445 | 0.854712042 | 0.857329843 | 0.846858639 | 0.846858639 | 0.839659686 | 0.841623037 | 0.837041885 |
| AVG | 0.704188482 | 0.847382199 | 0.845680628 | 0.844895288 | 0.840314136 | 0.832068063 | 0.829450262 | 0.821727749 | 0.82395288 |
| STD | 0 | 0.016016793 | 0.005605396 | 0.008036692 | 0.00682639 | 0.008498787 | 0.008902448 | 0.012895161 | 0.010577018 |



Similar as testPenData, increasing the number of hidden layer increases the average accuracy. It hits a plateau after 5, and stays around the same after. The max is very close to the average accuracy value.

Question 7. XOR
Starting training at time 23:55:05.488371 with 2 inputs, 1 outputs, [] hidden layers, size of training set 4, and size of test set 4
Finished after 100000 iterations at time 23:55:12.088871 with training error 0.126577 and weight change 0.008385
Feed Forward Test correctly classified 2, incorrectly classified 2, test percent error  0.000000

# nodes in the hidden layer: 0
Age Accuracy: 0.500000 accuracy


Starting training at time 23:55:12.090498 with 2 inputs, 1 outputs, [1] hidden layers, size of training set 4, and size of test set 4
Finished after 100000 iterations at time 23:55:22.574575 with training error 0.083854 and weight change 0.001489
Feed Forward Test correctly classified 3, incorrectly classified 1, test percent error  0.000000

# nodes in the hidden layer: 1
Age Accuracy: 0.750000 accuracy


Starting training at time 23:55:22.574665 with 2 inputs, 1 outputs, [2] hidden layers, size of training set 4, and size of test set 4
Finished after 11820 iterations at time 23:55:24.246792 with training error 0.001178 and weight change 0.000080
Feed Forward Test correctly classified 4, incorrectly classified 0, test percent error  0.000000

# nodes in the hidden layer: 2
Age Accuracy: 1.000000 accuracy