**Question 5: Learning With Restarts**

testPenData Accuracy

Max: 0.909376786735

Average: 0.90354488279

Standard Deviation: 0.0078864932642

testCarData Accuracy

Max: 0.875654450262

Average: 0.839790575916

Standard Deviation: 0.02278915722

**Question 6: Varying The Hidden Layer**

Data from testPenData Runs

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Perceptrons | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 |
| Max Accuracy | 0.0000 | 0.8453 | 0.8988 | 0.9082 | 0.9017 | 0.9065 | 0.9079 | 0.9065 | 0.9062 |
| Average Accuracy | 0.0000 | 0.8416 | 0.8899 | 0.9047 | 0.8969 | 0.9027 | 0.9034 | 0.9035 | 0.8979 |
| Standard Deviation | 0.0000 | 0.0019 | 0.0065 | 0.0037 | 0.0030 | 0.0026 | 0.0039 | 0.0024 | 0.0070 |

For the testPen dataset, the improvement in average accuracy for the neural networks seems to fall off dramatically after 5 hidden layer perceptrons, with little discernible difference in average accuracy among networks with 10-40 perceptrons. In this case, the neural net was unable to function with 0 perceptrons.

Data from testCarData Runs

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Perceptrons | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 |
| Max Accuracy | 0.7042 | 0.9018 | 0.8953 | 0.8894 | 0.8691 | 0.8835 | 0.8770 | 0.8665 | 0.8632 |
| Average Accuracy | 0.7042 | 0.8847 | 0.8805 | 0.8715 | 0.8588 | 0.8652 | 0.8675 | 0.8521 | 0.8537 |
| Standard Deviation | 0.0000 | 0.0142 | 0.0181 | 0.0133 | 0.0077 | 0.0114 | 0.0103 | 0.0119 | 0.0061 |

For the testCar dataset, the improvement in average accuracy for the neural networks seems to fall off *at* 5 hidden layer perceptrons, with little discernible difference in average accuracy among networks with 5-40 perceptrons. In fact, the average accuracy trended slightly down as the number of perceptrons increased. However, the network still boasted 70% accuracy with 0 hidden layer perceptrons.