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Project 4 Analysis

Question 5: From the data given, we can see that the Neural Network when run on the pen data gave an average percentage of correct test cases of 90.03%. The percent of correct test cases for the car data was slightly lower at 84.4%. Also, the standard deviation for the car data was slightly higher so there was more variability in the result for that data set.

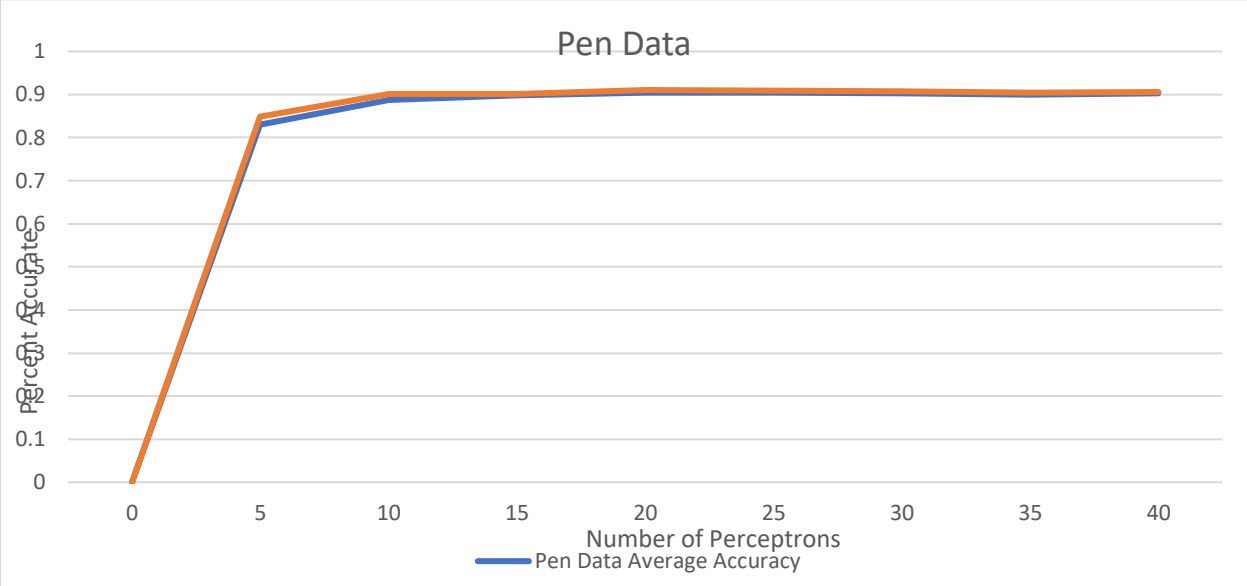
Pen Data				Car Data		
Maximum	Average	Std Deviation		Maximum	Average	Std Deviation
0.90909091	0.90034305	0.00799354		0.85863874	0.84397906	0.01006747 9

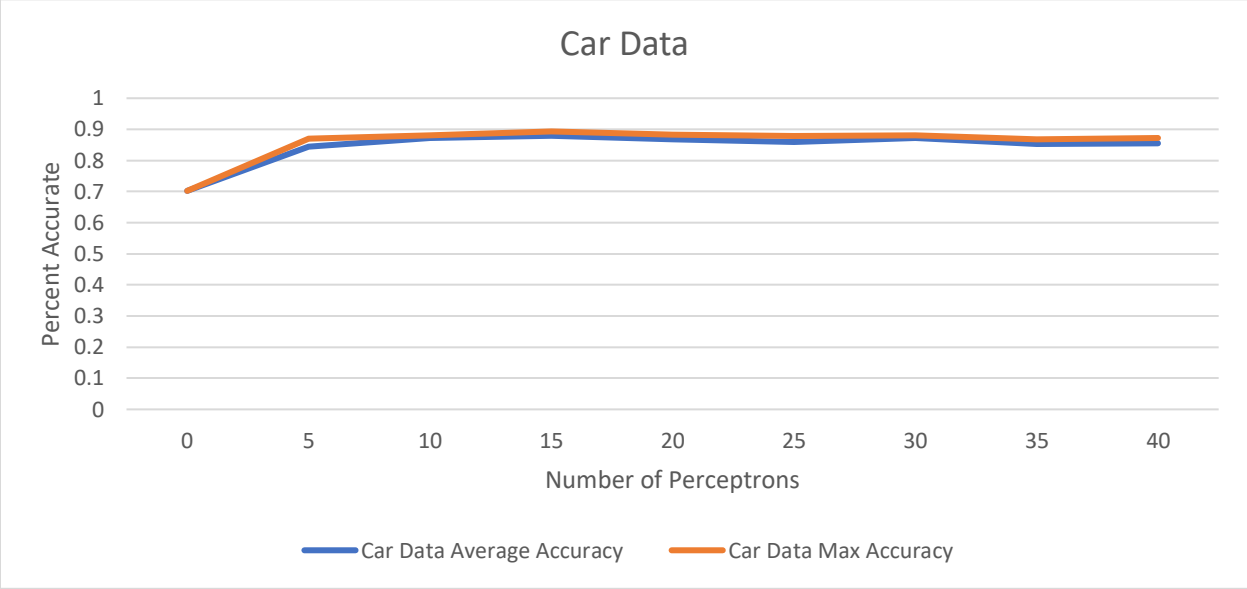
Question 6: As you can see from the tables and graphs, the pen data average accuracy was much higher than the car data accuracy. Also, the neural net produced about 1/5 – 1/2 of the deviation in the accuracy of the test cases for the pen data vs the car data. For the pen data, the neural network had very low accuracy at first, then jumped up at 10 perceptrons in the hidden layer. After the spike, the accuracy rose just a little more and flatlined around 90% for the remaining amounts of neurons (15-40). The network gave similar results for the car data, but the overall average accuracy was lower and there was a lot more fluctuation in the numbers. This shows that increasing the size of the hidden layers helps a lot at first, but then reaches an asymptote where adding more perceptrons doesn't have much if any effect on the results. The results are not exactly what I expected. I expected the larger hidden layers to allow for better results. But to my surprise this is only true up to a certain threshold.

Pen Data			
Number of Neurons	Average Accuracy	Max Accuracy	Std Deviation
0	0	0	0
5	0.829502573	0.848770726	0.017713898
10	0.886906804	0.901372213	0.009764469
15	0.897655803	0.90165809	0.005268222
20	0.90383076	0.910520297	0.007052782
25	0.904516867	0.909376787	0.003406625
30	0.902801601	0.907089766	0.004126949
35	0.899942824	0.904516867	0.005280617
40	0.902458548	0.905660377	0.002610111

Car Data			
Number of Neurons	Average Accuracy	Max Accuracy	Std Deviation
0	0.70222513	0.70222513	0
5	0.84410995	0.86910995	0.01335079

10	0.87159686	0.8815445	0.00799823
15	0.87931937	0.89332461	0.00766126
20	0.86767016	0.8828534	0.01219035
25	0.85994764	0.8776178	0.01212412
30	0.87146597	0.8815445	0.00732984
35	0.85287958	0.8671466	0.01339562
40	0.85497382	0.8723822	0.01028633

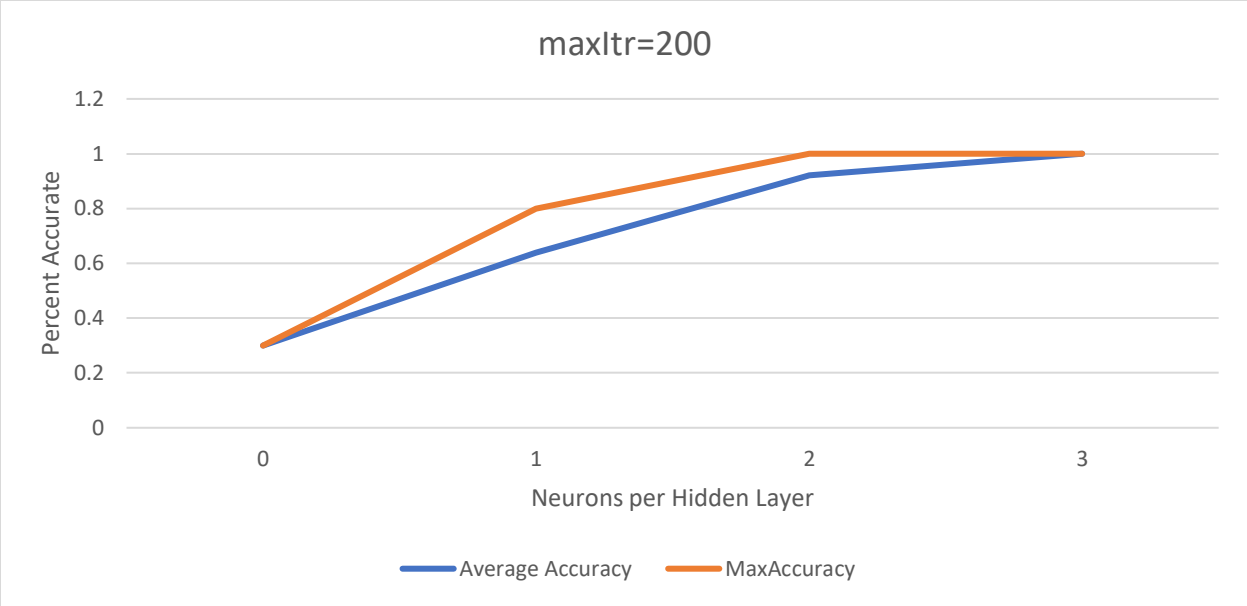




Question 7: For this question, I changed the maxIterations ranging from 60 to 1600 iterations. As the number of iterations of learning increased, the number of perceptrons in the hidden layer required to reach a 100% accuracy decreased. With the standard number of iterations (maxItr=200), the average accuracy started at .3 and increased on a logarithmic curve before

reaching an average accuracy of 1 at only 3 neurons per hidden layer. This was surprisingly low to me. I expected at least 10 neurons per hidden layer based on the data from question 6. This was clearly an easier data set to analyze, but I still thought it would not have been this low. The overall trend of accuracy is exactly what I expected. As the number of perceptrons in the hidden layer increased, the accuracy also increased. It was able to correctly predict the non-linear function better as the hidden layer got larger with the best accuracy at 3 neurons and the worst accuracy with no hidden layer.

maxItr=60	Number of Perceptrons	Average Accuracy	MaxAccuracy	Std Deviation
	0	0.45	0.45	0
	1	0.57	0.85	0.227156334
	2	0.61	1	0.386522962
	3	0.83	1	0.14
	4	0.65	1	0.214476106
	5	0.82	1	0.24
	6	0.94	1	0.12
	7	1	1	0
maxItr=200	Number of Perceptrons	Average Accuracy	MaxAccuracy	Std Deviation
	0	0.3	0.3	0.3
	1	0.64	0.8	0.8
	2	0.92	1	0.16
	3	1	1	0
maxItr=600	Number of Perceptrons	Average Accuracy	MaxAccuracy	Std Deviation
	0	0.45	0.45	0
	1	0.68	0.8	0.12083046
	2	0.84	1	0.205912603
	3	1	1	0
maxItr=1600	Number of Perceptrons	Average Accuracy	MaxAccuracy	Std Deviation
	0	0.5	0.5	0
	1	0.76	0.8	0.037416574
	2	1	1	0


maxItr=200
1.2
1
0.8
0.6
0.4
0.2
0
Percent Accurate
0
1
2
3
Neurons per Hidden Layer
Average Accuracy
MaxAccuracy