Neural Net Report

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Question 5: Learning With Restarts

1. **testPenData**:
   - Max accuracy: .9065
   - Average accuracy: 0.9045
   - Standard deviation: 0.002195
2. **testCarData**:
   - Max accuracy: .99
   - Average accuracy: 0.985
   - Standard deviation: 0.00316

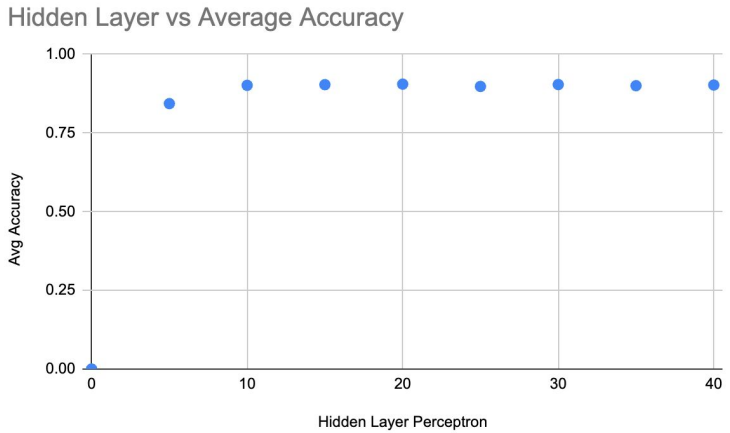
Question 6: Varying the Hidden Layers

Statistic table for **testPenData** – report the max, average, and standard deviation at various amount of perceptrons.

	Number of Perceptrons at the Hidden Layer								
	0	5	10	15	20	25	30	35	40
Max Accuracy	0	0.8547	0.9271	0.9085	0.9093	0.9093	0.9102	0.9076	0.9048
Avg Accuracy	0	0.8434	0.9016	0.9037	0.9053	0.8980	0.9040	0.9004	0.90257
Standard Deviation	0	0.0086	0.0144	0.0052	0.0028	0.0083	0.0035	0.0069	0.002659

Question 6: Varying the Hidden Layers

Create a learning curve for **testPenData** where the number of hidden layer perceptrons is the independent variable and the average accuracy is the dependent variable.



Question 6: Varying the Hidden Layers

For **testPenData**, discuss any notable trends you saw related to increasing the size of the hidden layers in your neural net.

Answer: The average accuracy increased rapidly with small number of perceptrons. It peaked around 15-20 perceptrons. After this, the average accuracy saw no high increase. This resulted in diminishing returns with higher levels of computation with more perceptrons.

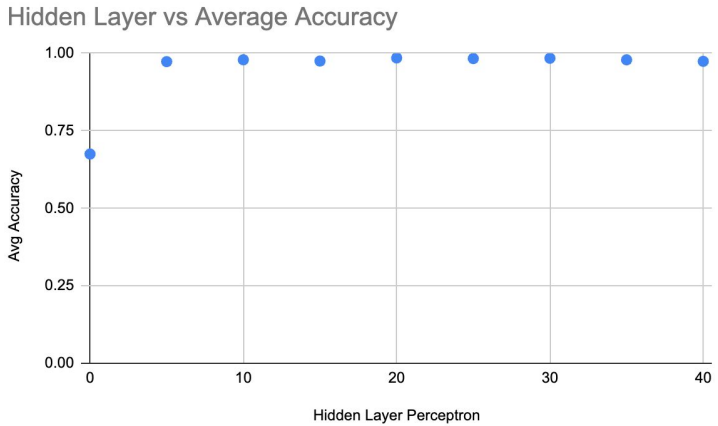
Question 6: Varying the Hidden Layers

Statistic table for **testCarData** – report the max, average, and standard deviation at various amount of perceptrons.

	Number of Perceptrons at the Hidden Layer								
	0	5	10	15	20	25	30	35	40
Max Accuracy	0.675	0.985	0.985	0.98	0.99	0.99	0.99	0.985	0.98
Avg Accuracy	0.675	0.973	0.979	0.975	0.985	0.983	0.984	0.9789	0.974
Standard Deviation	0.0	0.0136	0.0063	0.0077	0.0045	0.004	0.0037	0.0037	0.0058

Question 6: Varying the Hidden Layers

Create a learning curve for **testCarData** where the number of hidden layer perceptrons is the independent variable and the average accuracy is the dependent variable.



Question 6: Varying the Hidden Layers

For **testCarData**, discuss any notable trends you saw related to increasing the size of the hidden layers in your neural net.

Answer: When there is no hidden layers, there was a notable difference in avg. accuracy. With 5-15 hidden layers, there is a gradual increase in avg. accuracy. After 15 hidden layers, the avg. accuracy eventually converges to around 98% avg. accuracy. At 40 hidden layers, the neural network might have overfitted causing an increase in std deviation. An increase in hidden layers can put the network at risk of overfitting. The computation increase as more hidden layers are added. Thus increasing hidden layers past 40 gives diminishing returns compared to computational effort.

Question 7 (extra credit): Learning XOR

Report the max accuracy, average accuracy, and standard deviation of the neural net that you have trained with 1) no hidden layer, and 2) a hidden layer with various amount of perceptrons (at least 3 different amounts)

	No Hidden Layer	Hidden Layer		
		5 perceptrons	10 perceptrons	15 perceptrons
Max Accuracy	0.50	0.75	0.75	1.0
Avg Accuracy	0.35	0.55	0.70	0.90
Standard Deviation	0.12247	0.10	0.10	0.12247

Question 7 (extra credit): Learning XOR

Report the behavior of the trained neural net **without a hidden layer**.

Answer: Without a hidden layer, the perceptron either gave a score of 50 or 25. It performed poorly.

Question 7 (extra credit): Learning XOR

Report the behavior of the trained neural net **with a hidden layer**. Are the results what you expected? Explain your observation.

Answer: With past question, I believe this neural net would perform better. As I expected, the more hidden layers added had returned higher average accuracies. With 15 perceptron hidden layers, the neural net returned 90% average accuracy.

Question 8 (extra credit): Novel Dataset

List the name and the source of the dataset that you've chosen.

- Name: _____
- Source (e.g., URLs): _____
- Briefly describe the dataset: _____

Question 8 (extra credit): Run Stats

- Max accuracy: _____
- Average accuracy: _____
- Standard deviation: _____

Question 8 (extra credit): Novel Dataset

Describe how to run the code that you've set up to train the selected dataset.

Answer: