Neural Net Report

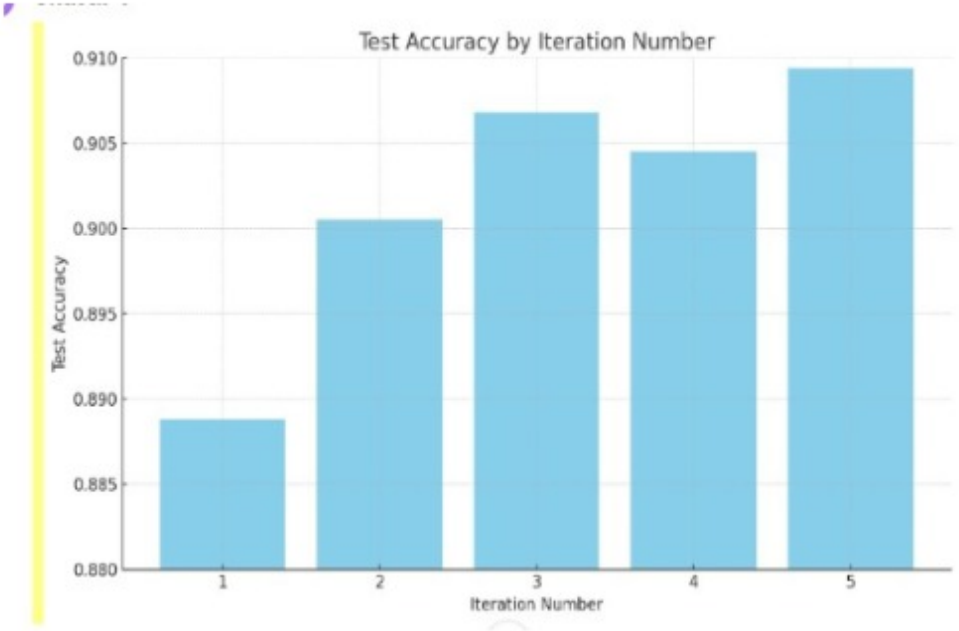
Your Name: Mohammad Dabeer Ahmed

Your Yale netID: MA2466

Question 5: Learning With Restarts

1. **testPenData**:
   - Max accuracy: 0.9093767867352773
   - Average accuracy: 0.9020011435105776
   - Standard deviation: 0.007217264088209622

Iteration Number	Training Error	Weight Change	Test Accuracy
1	0.002801	0.000080	0.888794
2	0.002770	0.000081	0.900515
3	0.002804	0.000081	0.906804
4	0.002889	0.000081	0.904517
5	0.002657	0.000080	0.909377

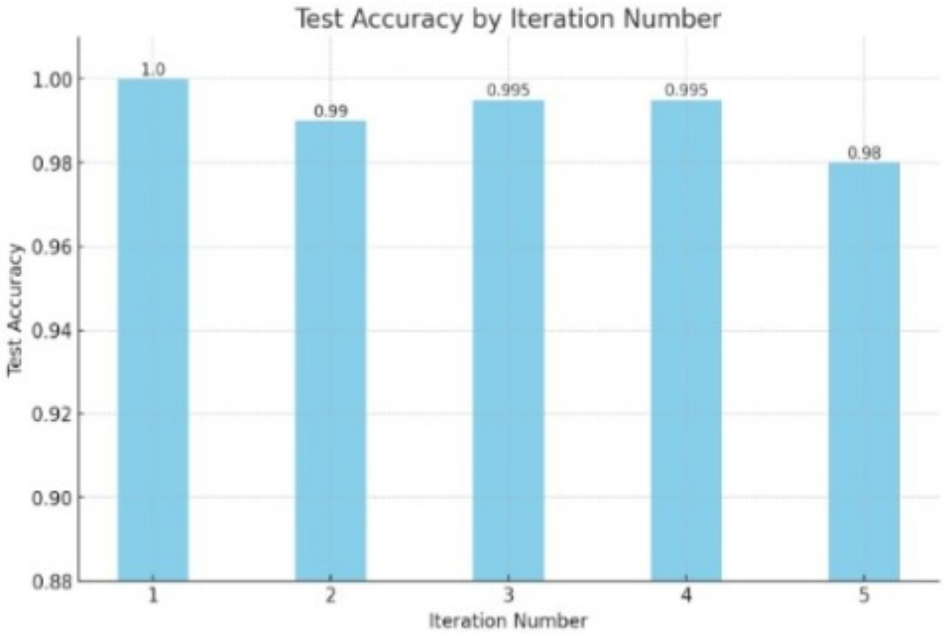


Question 5: Learning With Restarts

2. testCarData:

- Max accuracy: 1.0
- Average accuracy: 0.992
- Standard deviation: 0.006782329983125274

Iteration	Training Error	Weight Change	Test Accuracy
1	0.001864	0.000080	1.000
2	0.001880	0.000080	0.990
3	0.002036	0.000081	0.995
4	0.002243	0.000080	0.995
5	0.002118	0.000080	0.980



Question 5: Learning With Restarts

Your analysis:

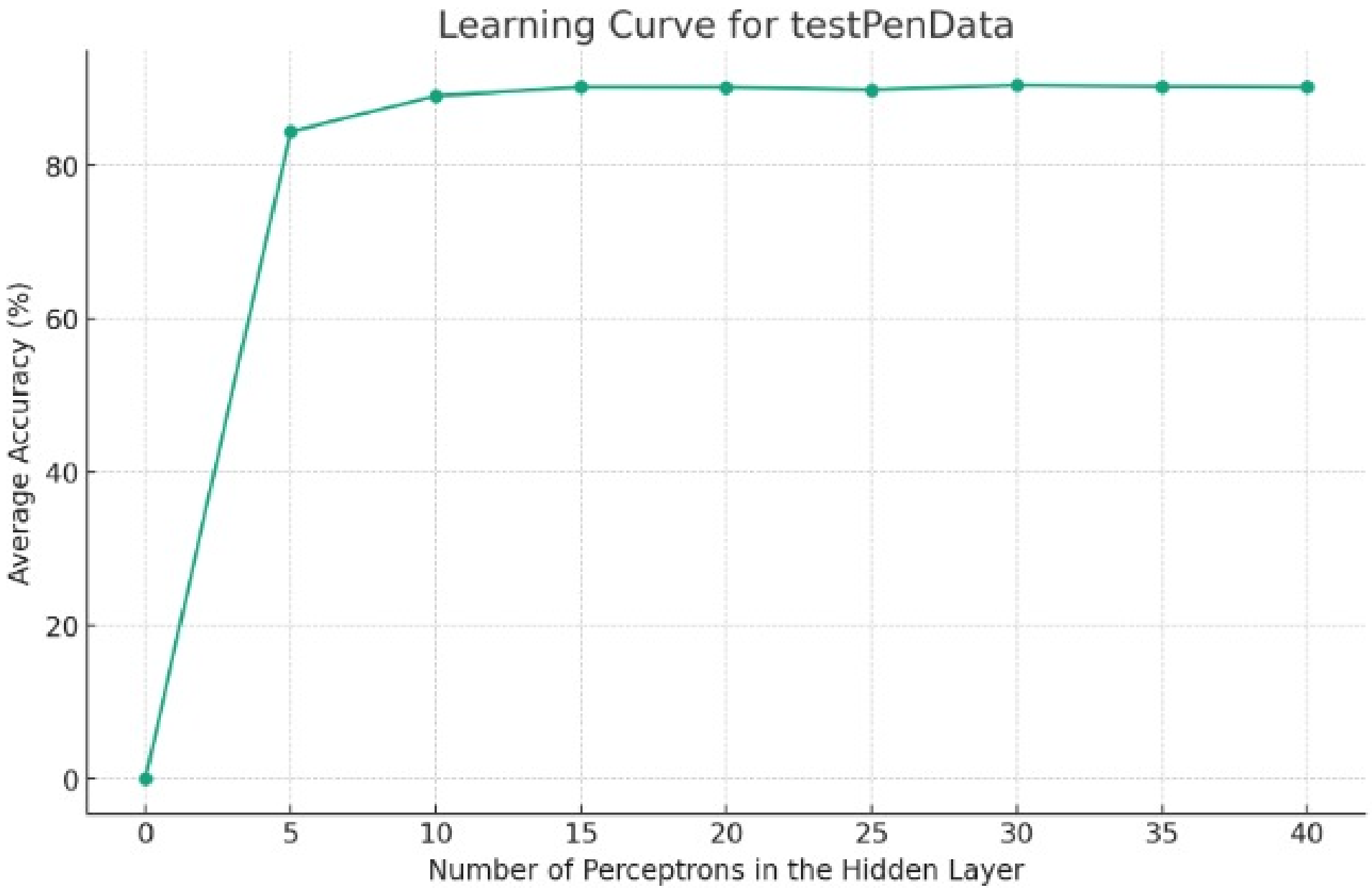
The neural network demonstrates stable performance with high test accuracies and minimal variance across five iterations for both pen and car data sets. Training error and weight change values decrease steadily, indicating effective learning and convergence. However, the perfect accuracy on car data suggests a risk of overfitting.. Variability across iterations highlights the influence of initial weight settings on model performance. While results are promising, further testing is needed to confirm the model's generalizability and robustness. The low standard deviation in accuracy suggests the performance differences are not statistically significant.

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	0.00	85.76	89.99	90.79	90.79	90.99	90.59	90.71	90.34
Avg Accuracy	0.00	84.40	89.06	90.19	90.17	89.85	90.43	90.27	90.18
Standard Deviation	0.00	0.84	0.61	0.40	0.75	0.89	0.12	0.26	0.12

all values are in %


Learning Curve for testPenData
Average Accuracy (%)
0
20
40
60
80
0
5
10
15
20
25
30
35
40
Number of Perceptrons in the Hidden Layer

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:

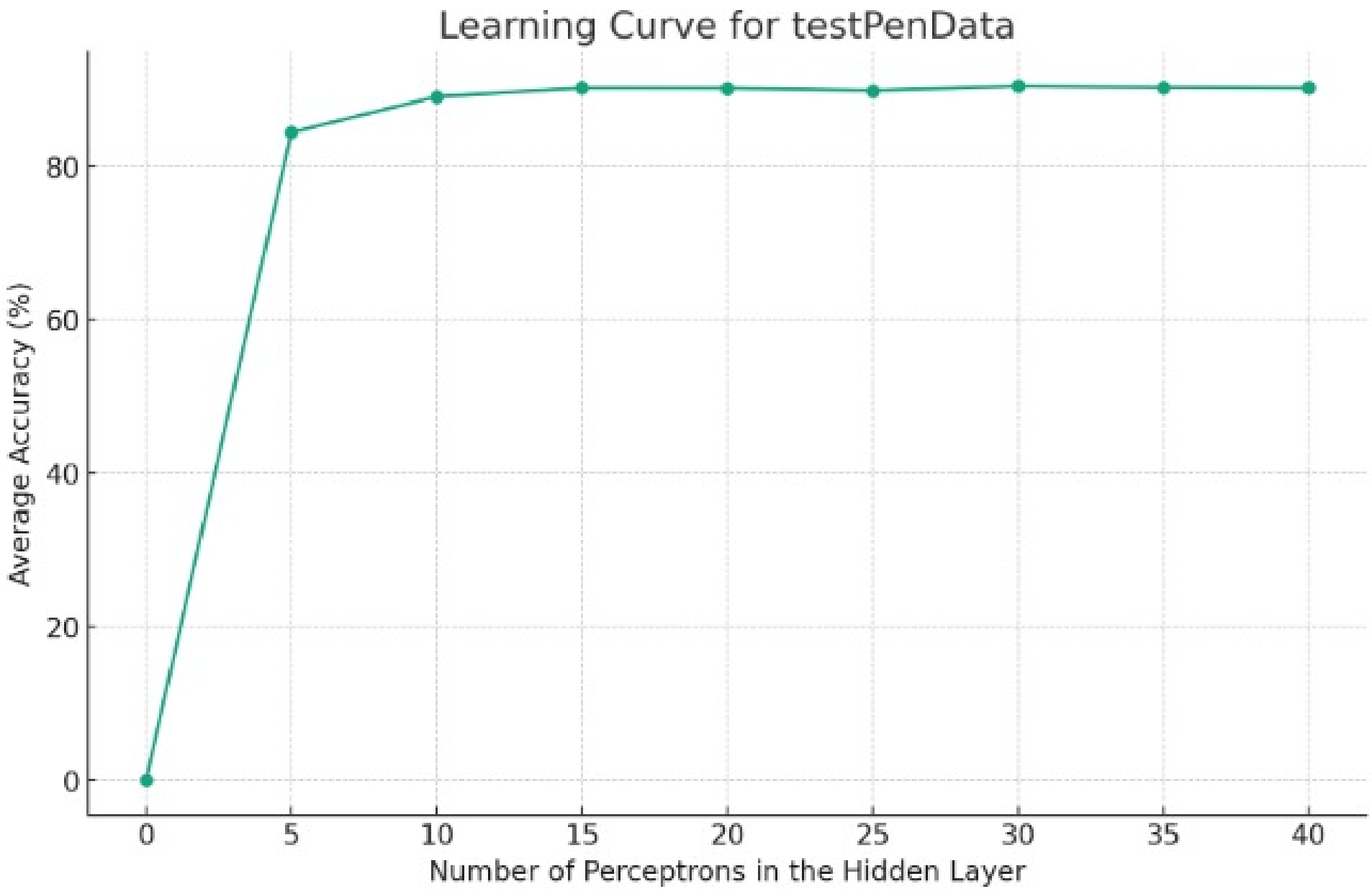
For testPenData, I observed a notable increase in accuracy as the number of perceptrons in my neural network increased to 15. This trend suggests that a more intricate network architecture enhances the model's ability to understand the complexity within the dataset. Yet, beyond this number, the incremental benefit of adding more perceptrons seemed to wane, and the accuracy reached a plateau. This pattern leads me to think that introducing too many perceptrons may not yield additional learning benefits and could, in fact, lead to overfitting.

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	0.72	99.50	99.50	99.50	99.00	99.00	99.00	99.00	99.00
Avg Accuracy	0.72	98.10	98.80	99.10	98.40	98.30	98.10	98.10	98.20
Standard Deviation	0.00	1.20	0.51	0.20	0.37	0.51	0.49	0.58	0.51

all values are in %


Learning Curve for testPenData
Average Accuracy (%)
0
20
40
60
80
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Number of Perceptrons in the Hidden Layer

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:

Regarding testCarData, the effect of augmenting the hidden layer perceptrons was more subdued. The average accuracy remained relatively unchanged regardless of the increased number of perceptrons. This consistency implies that the dataset may not necessitate a sophisticated model to reach the best outcomes, or it could mean that the network's base level of complexity is already adequate for capturing the data's inherent patterns.