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TRAINING SIMULATION OF LEARNING ALGORITHM FOR DEEP LEARNING NEURAL NETWORK

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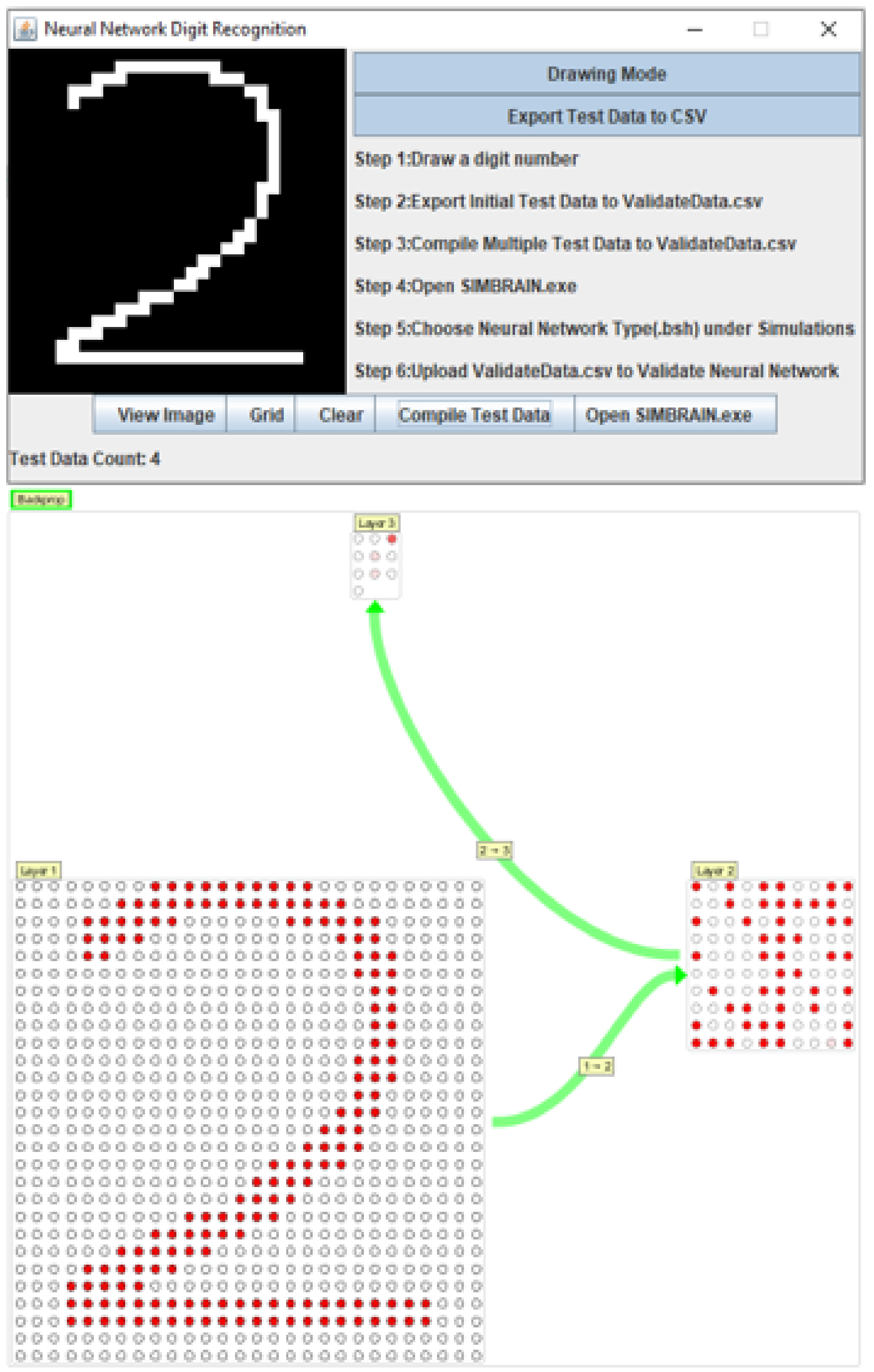
How to Train and Simulate Deep Learning Neural Networks?

Objectives

- Create Deep Learning Neural Network Simulator with the best condition of GUI application and neural network architecture
- Create Digit Recognition Simulator
- Programming Language : Java – Limited available resources
- Pruning Method : Noise Out – Latest and simple method(Mohammad Babaeizadeh,2017)
- Framework : Simbrain – Provide flexibility and User Interface in designing neural networks with its own Java library(Jeffery Yoshimi,2016)

Discussion

- The final training MSE and testing MSE for neural network with two hidden layers are smaller than the result from neural network with one hidden layer, yet, it requires more time to complete the training.
- The training MSE with Noise Out final pruning is larger than initial pruning except for the neural network with 700 neurons in its first layer.
- Both of the Noise Out pruning method reduce the elapsed time significantly



Neural Network Digit Recognition

Step 1:Draw a digit number

Step 2:Export Initial Test Data to ValidateData.csv

Step 3:Compile Multiple Test Data to ValidateData.csv

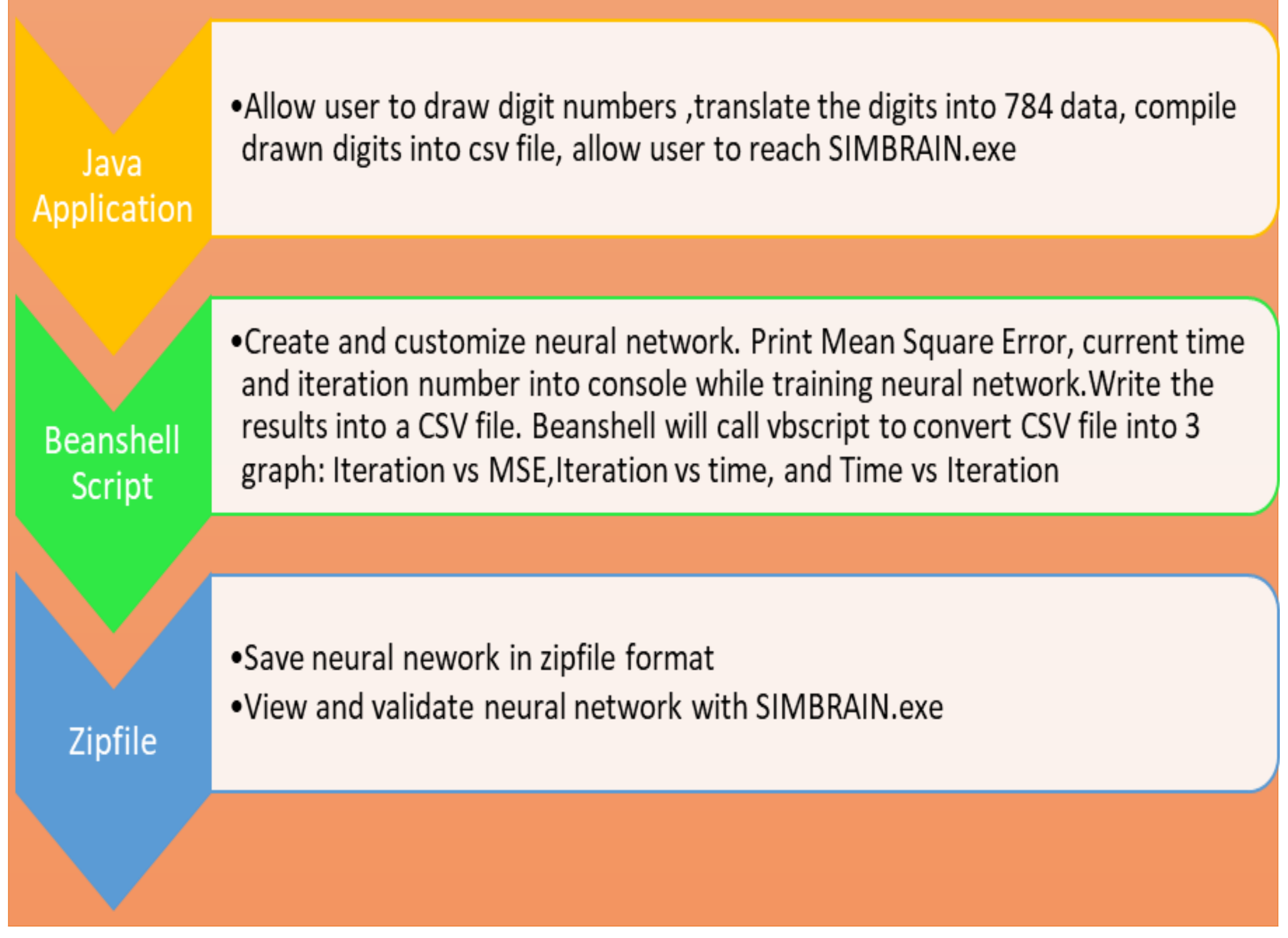
Step 4:Open SIMBRAIN.exe

Step 5:Choose Neural Network Type(.bsh) under Simulations

Step 6:Upload ValidateData.csv to Validate Neural Network

Test Data Count: 4

Methodology



Java Application
- Allow user to draw digit numbers ,translate the digits into 784 data, compile drawn digits into csv file, allow user to reach SIMBRAIN.exe

Beanshell Script
- Create and customize neural network. Print Mean Square Error, current time and iteration number into console while training neural network.Write the results into a CSV file. Beanshell will call vbscript to convert CSV file into 3 graph: Iteration vs MSE,Iteration vs time, and Time vs Iteration

Zipfile
- Save neural nework in zipfile format
- View and validate neural network with SIMBRAIN.exe

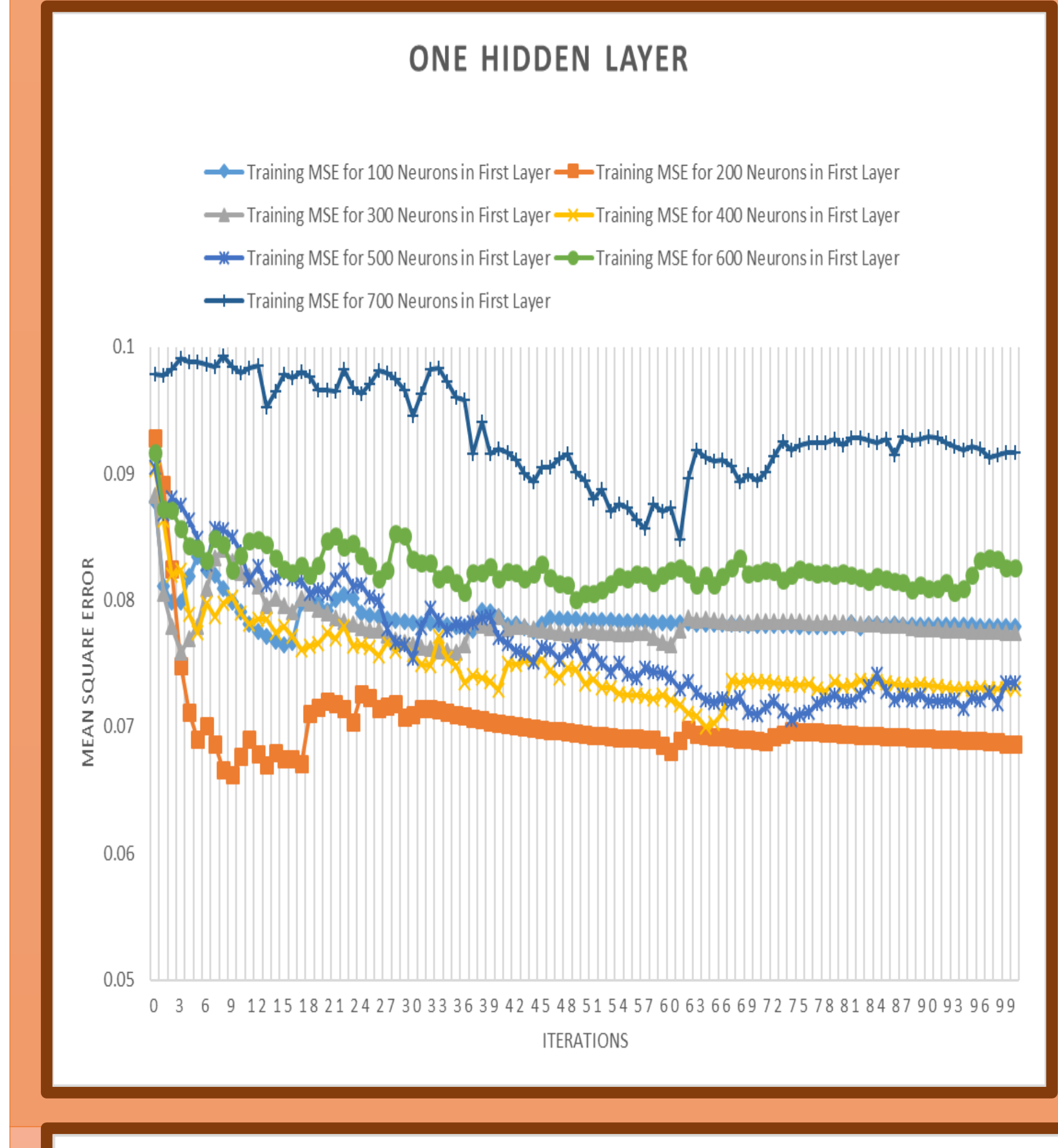
Conclusion

- Result for Neural Network with 700 neurons in First Hidden Layer

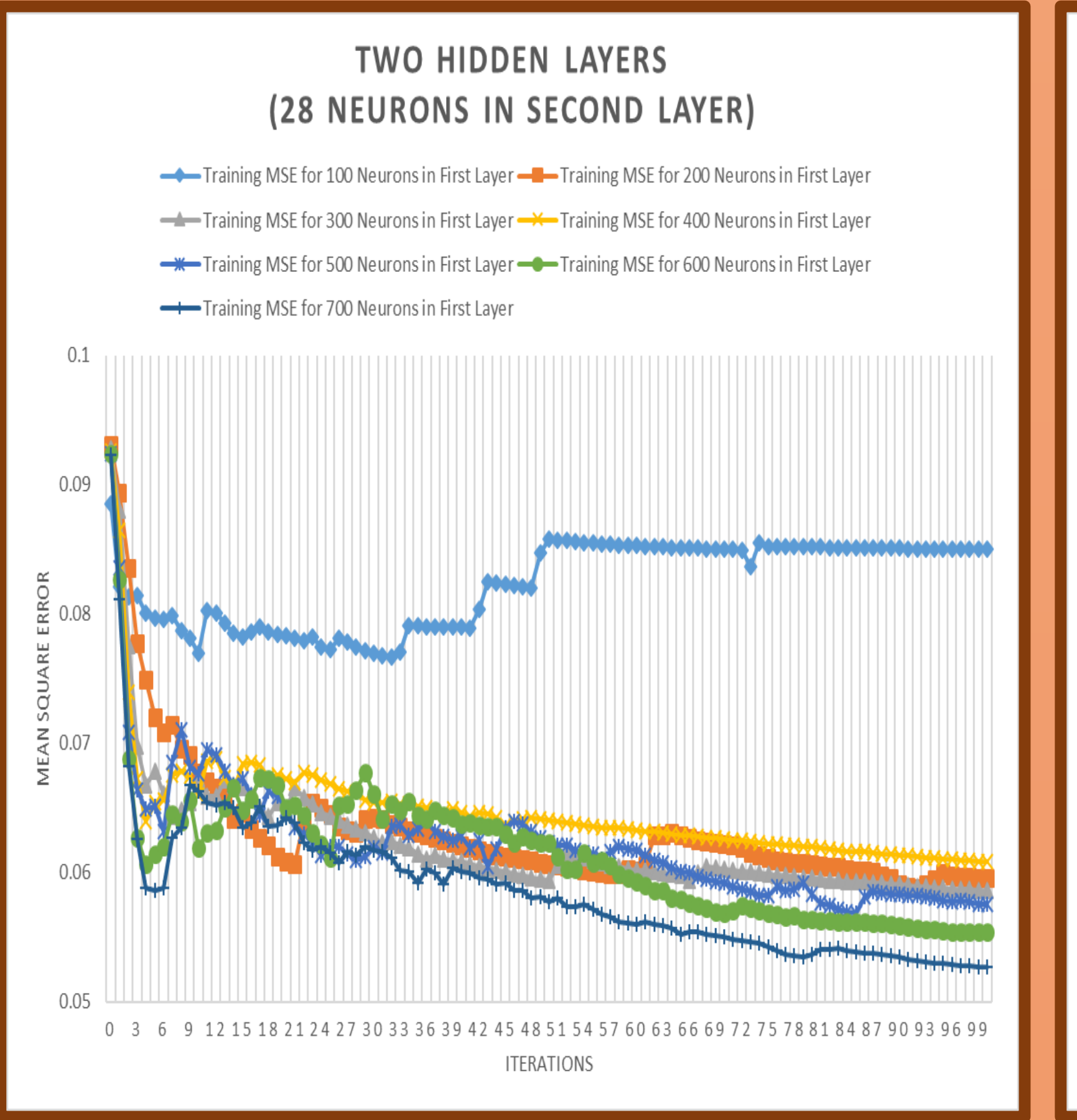
	One Hidden Layer	Two Hidden Layers and Noise Out Final Pruning	Performance
Final Training MSE	0.091648206	0.051732505	77%
Testing MSE	0.09457	0.063448041	49%
Elapsed Time	812.4977	508.5942	60%

Data

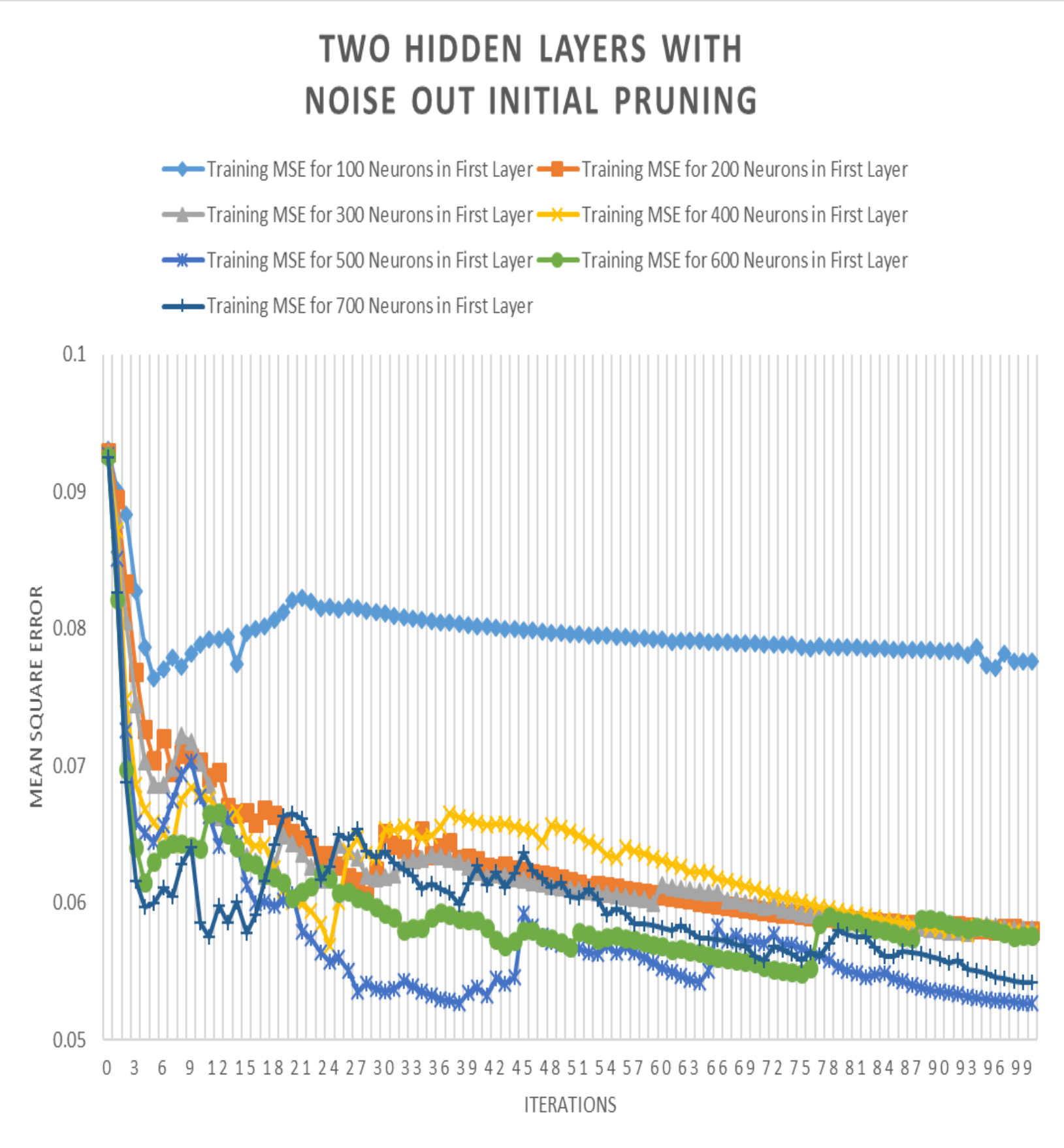
- Constant Variables : Number of Iterations = 100 ; Learning Rate = 0.01; Learning Momentum = 0.9; Number of Neurons in the Second Hidden Layer = 28; Algorithm for Training Neural Network = Backpropagation; Dataset = MNIST(1000 for Training and 500 for Testing)
- Noise Out initial pruning : Remove neuron with the higest activation value; Noise Out final pruning : Noise Out initial pruning + adding noise neuron with sigmoid rule



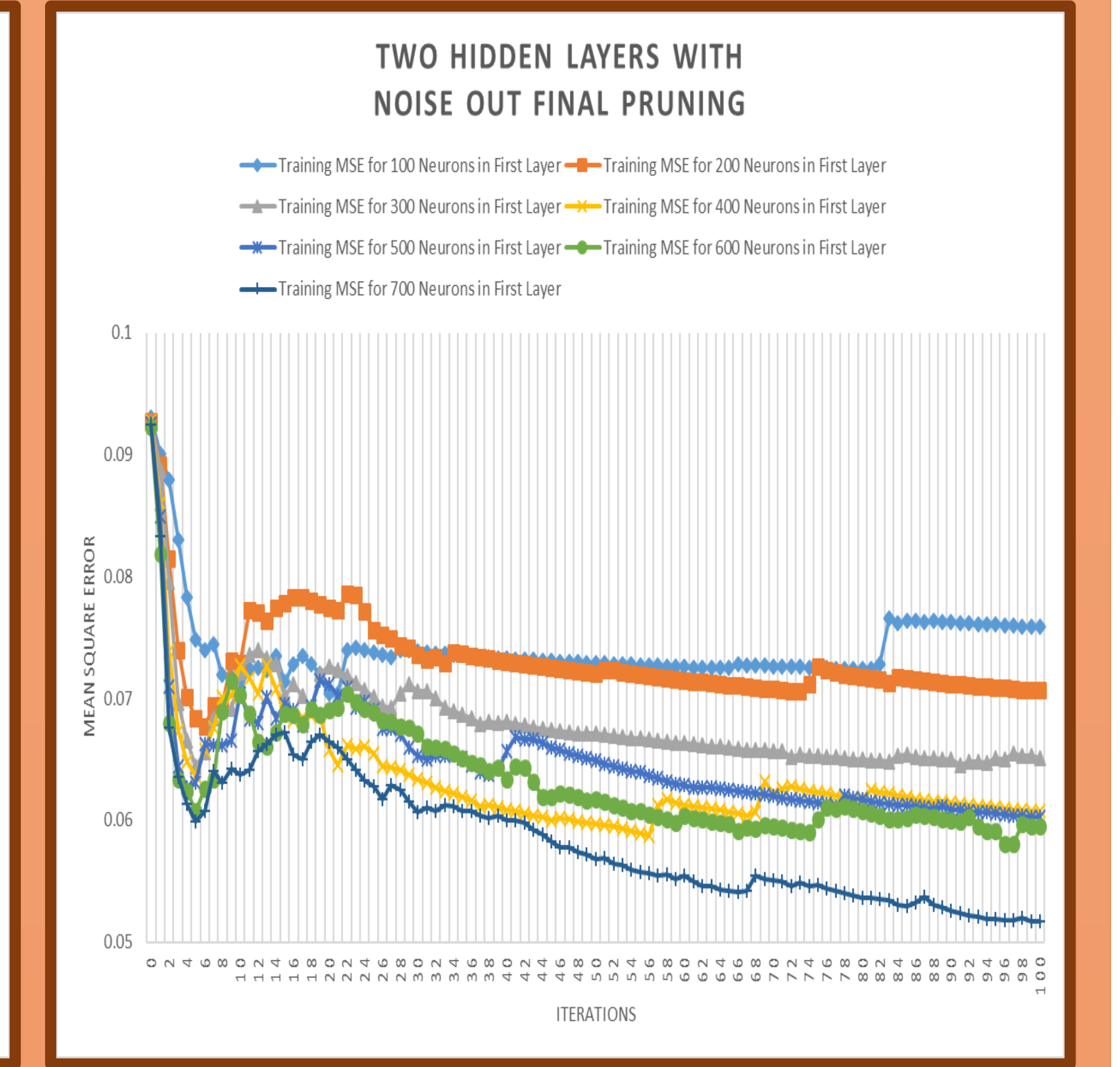
ONE HIDDEN LAYER



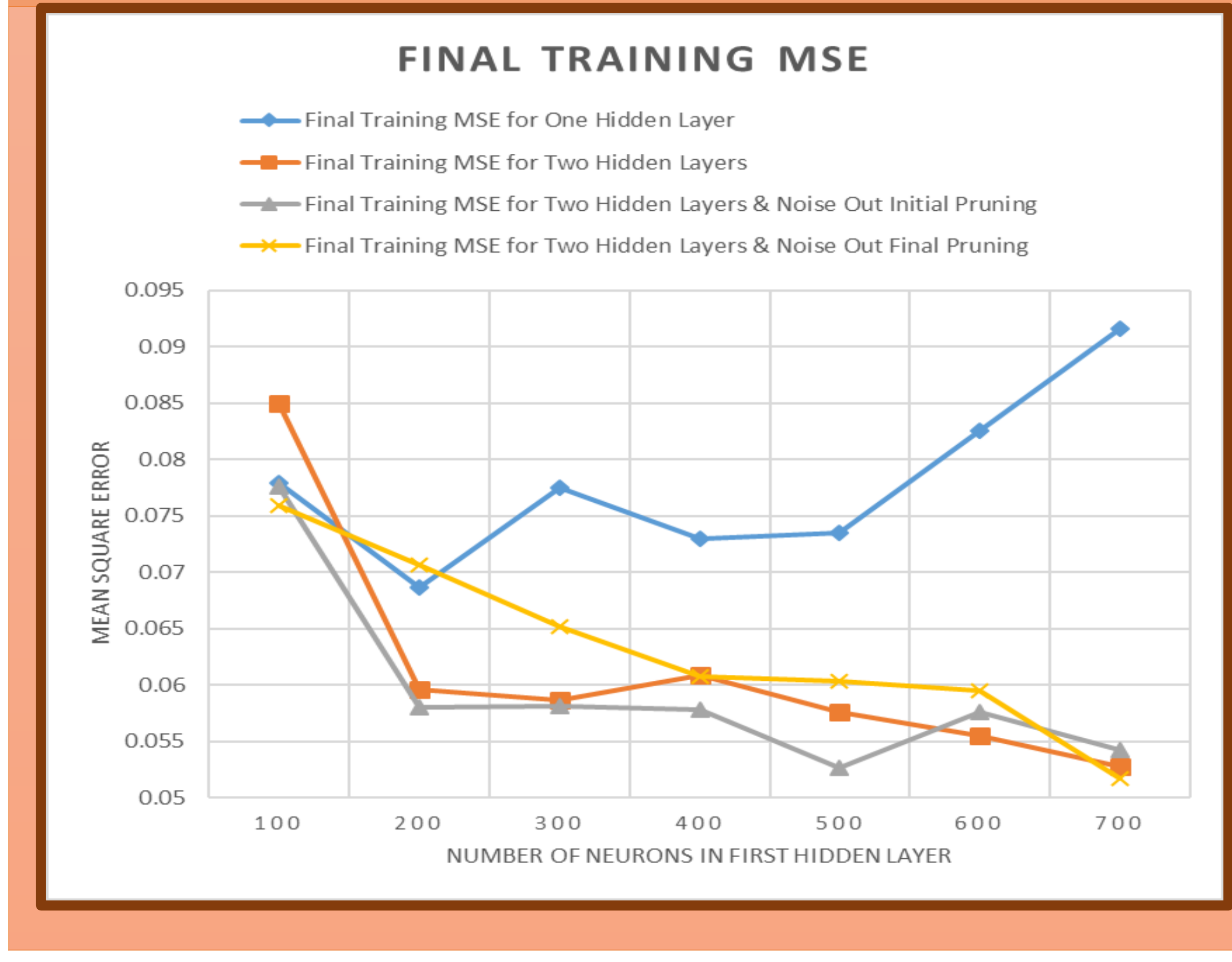
TWO HIDDEN LAYERS (28 NEURONS IN SECOND LAYER)



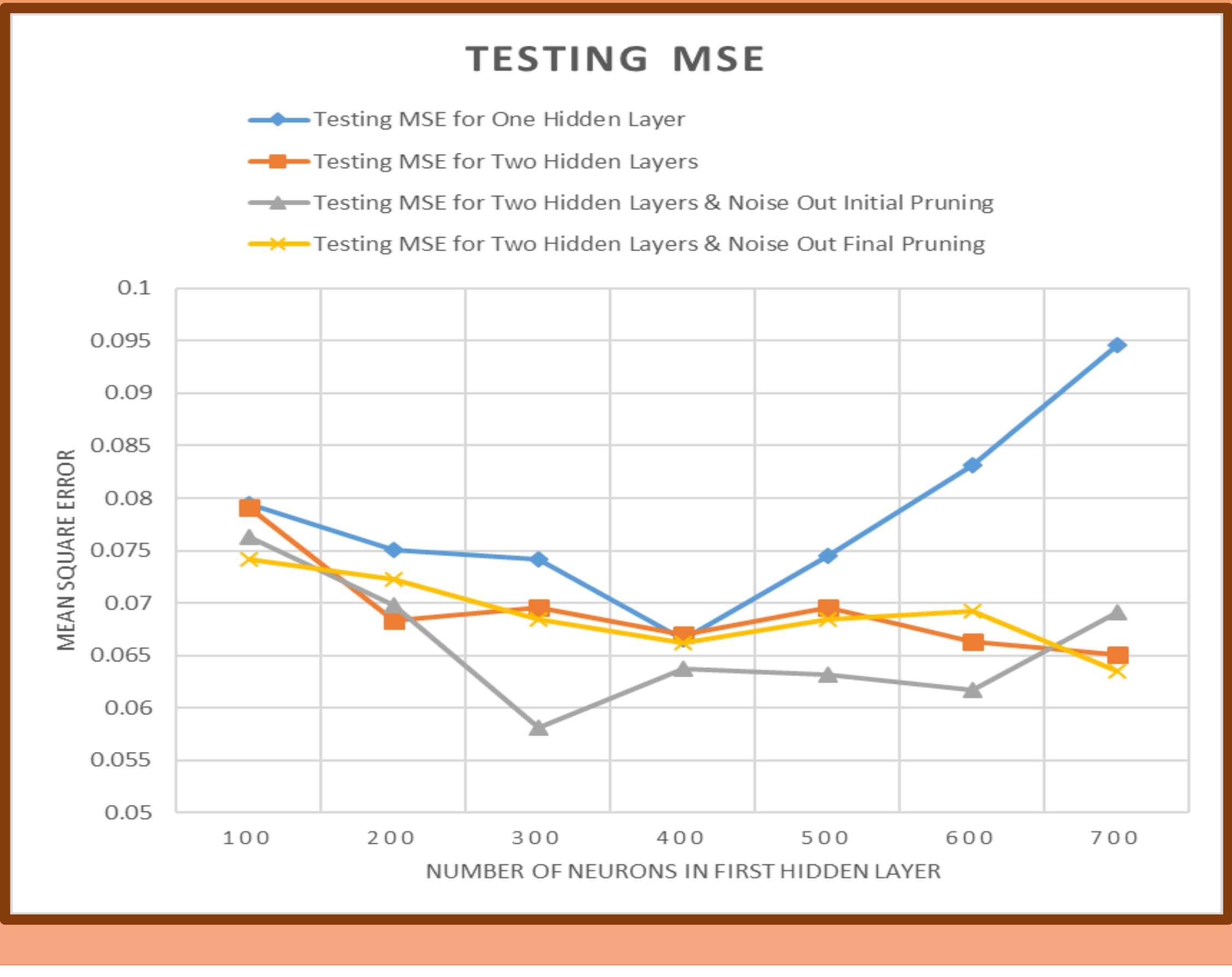
TWO HIDDEN LAYERS WITH NOISE OUT INITIAL PRUNING



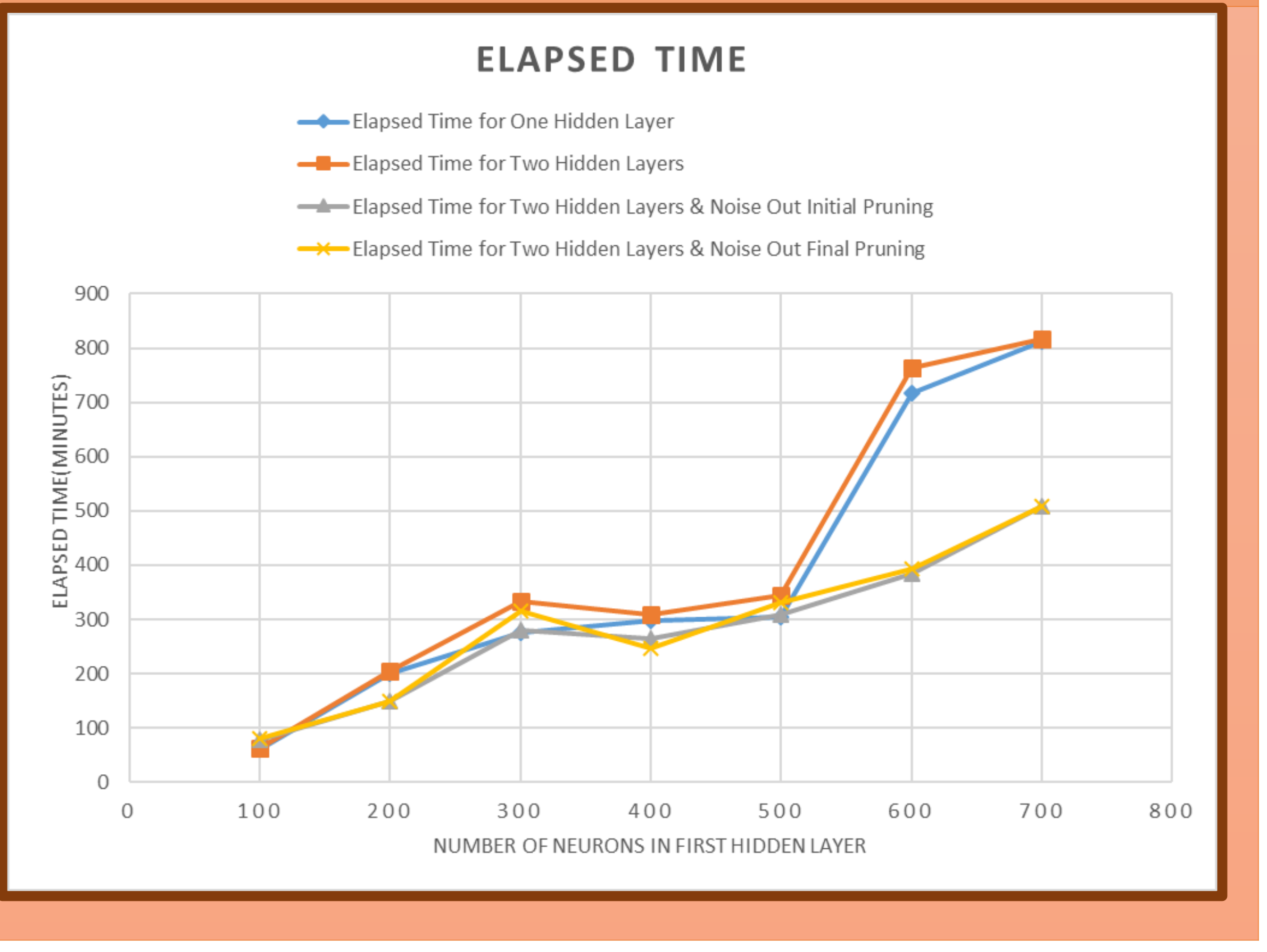
TWO HIDDEN LAYERS WITH NOISE OUT FINAL PRUNING



FINAL TRAINING MSE



TESTING MSE



ELAPSED TIME