ASSIGNMENT 3

CS5691 Pattern Recognition and Machine Learning

Team No. 26

Team Members:

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Function Approximation for Dataset 1 using MLFFNN with one hidden layer having 8 nodes

1.1) Training error (ξ av) vs epoch plot:

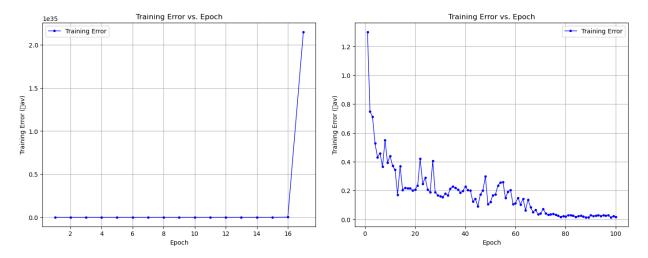


Figure 1: Training error Vs Epoch plot with learning rate = 0.7 (left) & 0.2 (right)

1.2) Scatter plots for the training data and the test data:

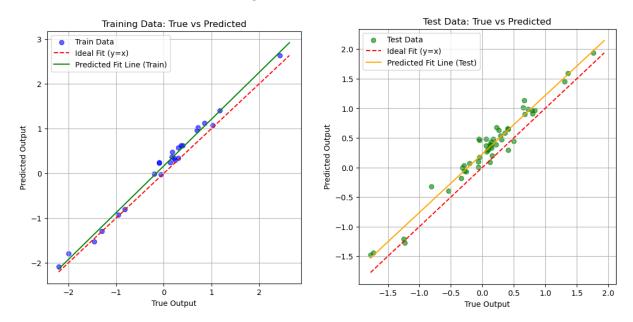


Figure 2: Scatter plots for Training data and testing data with learning rate = 0.2

1.3) Surface plots for outputs of any nodes in the hidden layer and the nodes in the output layer, after Epochs 1, 10, 50, and convergence:

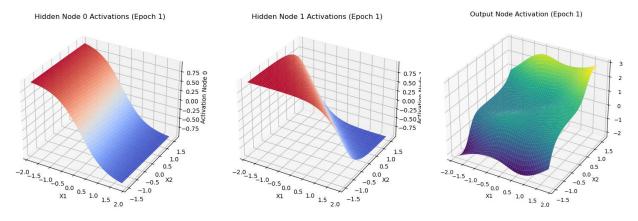


Figure 3: Surface plots for output of Hidden node 0 & 1 and Output Node with Epoch 1

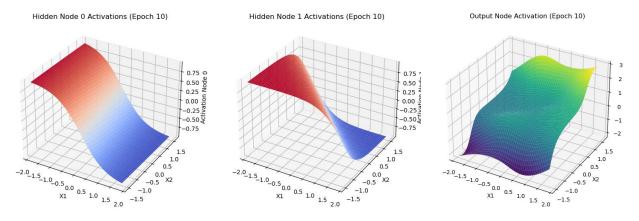


Figure 4: Surface plots for output of Hidden node 0 & 1 and Output Node with Epoch 10

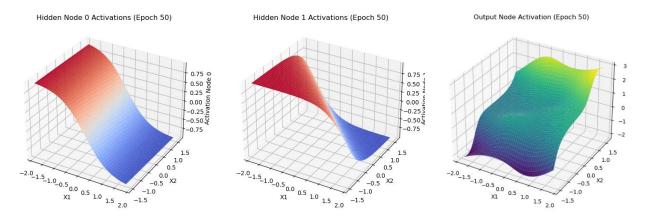


Figure 5: Surface plots for output of Hidden node 0 & 1 and Output Node with Epoch 50

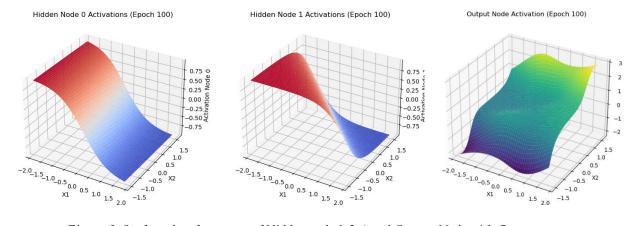


Figure 6: Surface plots for output of Hidden node 0 & 1 and Output Node with Convergence

Function Approximation for Dataset 2 using MLFFNN with two hidden layers having 15 nodes in the first hidden layer and 10 nodes in the second hidden layer

2.1) Training error (ξav) vs epoch plot:

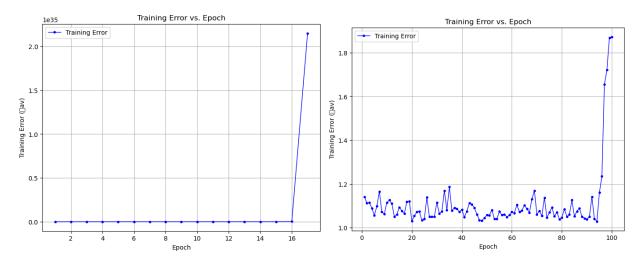


Figure 7: Training error Vs Epoch plot with learning rate = 0.7 (left) & 0.01 (right)

2.2) Scatter plots for the training data and the test data:

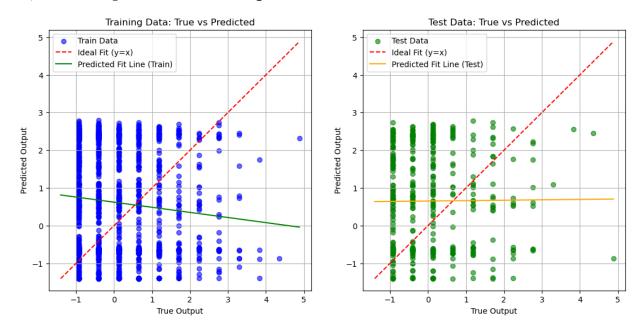


Figure 8: Scatter plots for Training data and testing data with learning rate = 0.01

3.1) GMM based classifier with 8 Gaussians per class

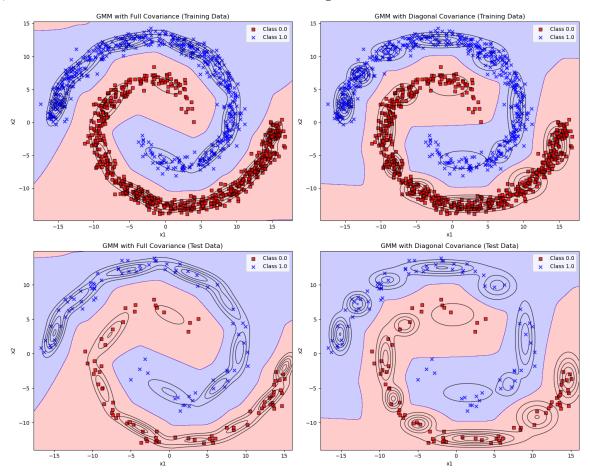


Figure 9: GMM with Full Covariance (Left) and Diagonal Covariance (Right)

Train & Test Accuracy: 100%

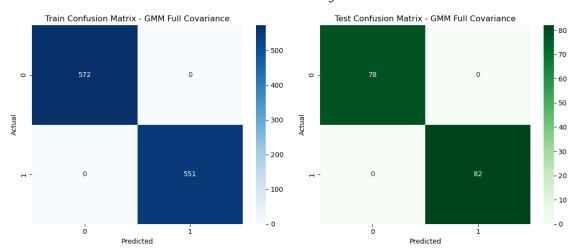


Figure 10: Confusion matrix for GMM Full covariance of Train (left) and Test (right) data

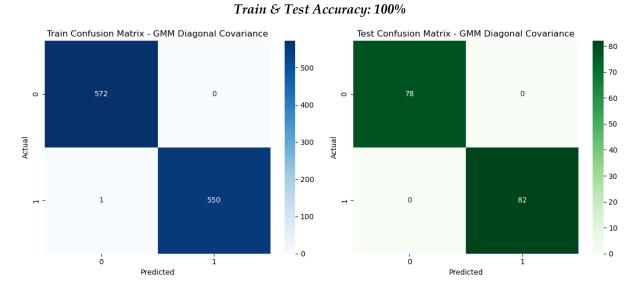


Figure 11: Confusion matrix for GMM Diagonal covariance of Train (left) and Test (right) data

3.2) MLFFNN based classifier with 12 nodes in the first hidden layer and 8 nodes in the second hidden layer:

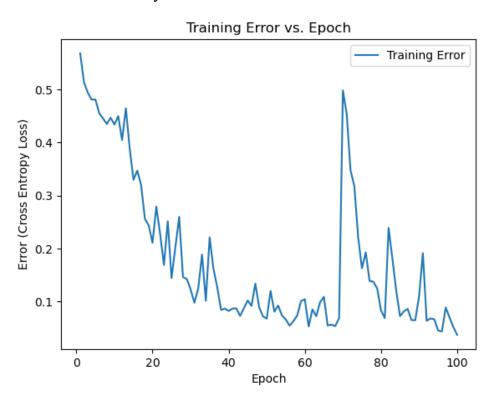


Figure **12**: *Training error Vs Epoch plot with learning rate* = 0.01

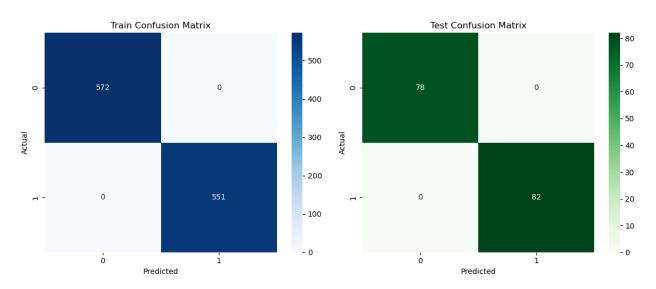


Figure 13: Confusion matrix of Train (left) and Test (right) data

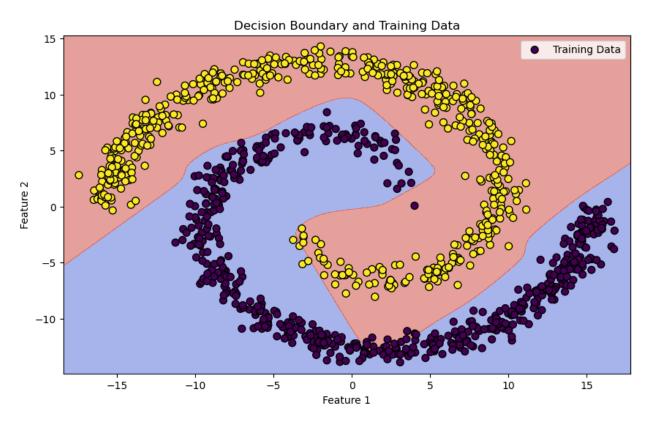


Figure 14: Decision Boundary of Training data

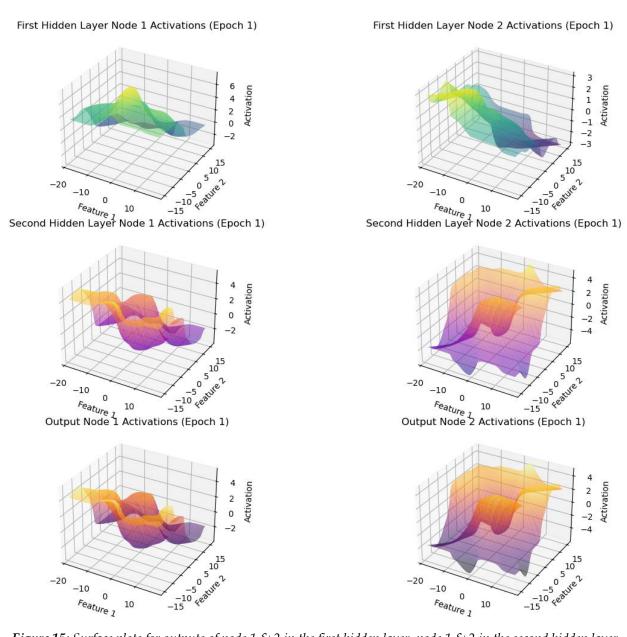


Figure 15: Surface plots for outputs of node 1 & 2 in the first hidden layer, node 1 & 2 in the second hidden layer and all the nodes in the output layers, after Epoch 1

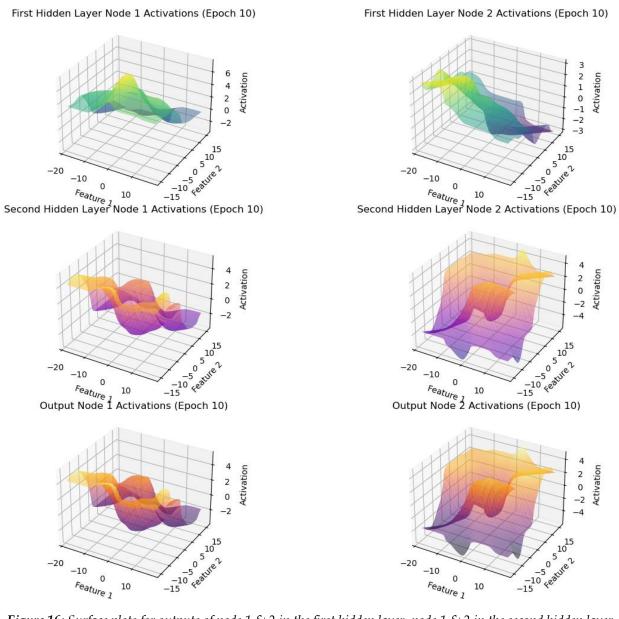


Figure 16: Surface plots for outputs of node 1 & 2 in the first hidden layer, node 1 & 2 in the second hidden layer and all the nodes in the output layers, after Epoch 10

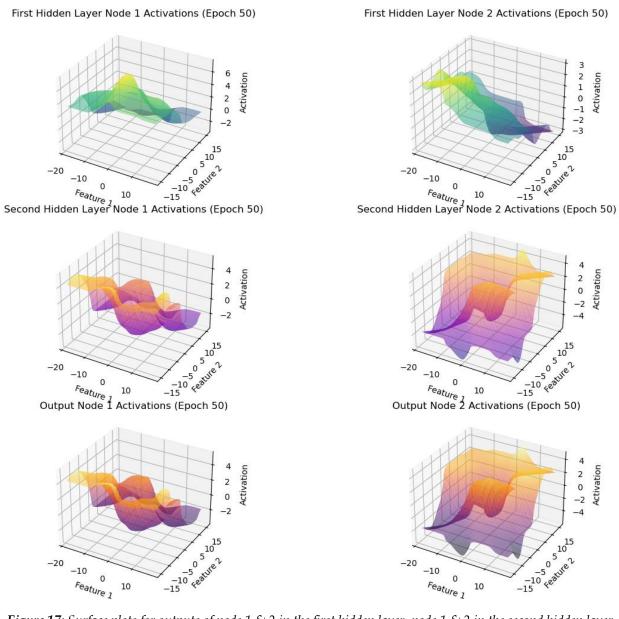


Figure 17: Surface plots for outputs of node 1 & 2 in the first hidden layer, node 1 & 2 in the second hidden layer and all the nodes in the output layers, after Epoch 50

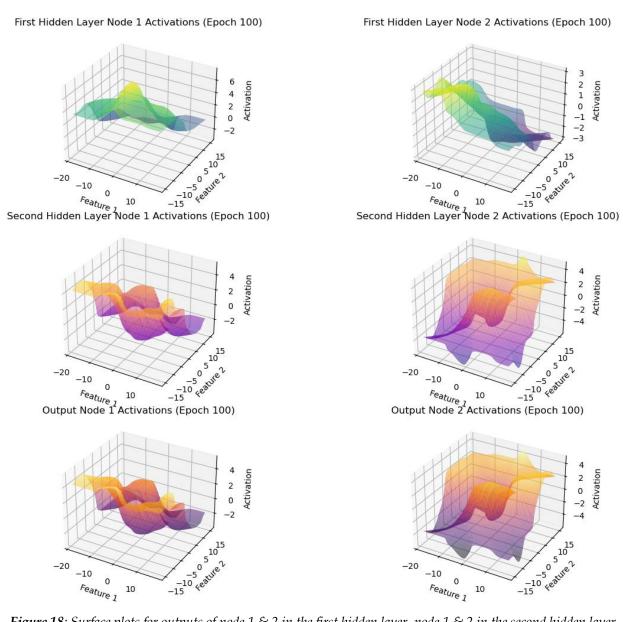


Figure 18: Surface plots for outputs of node 1 & 2 in the first hidden layer, node 1 & 2 in the second hidden layer and all the nodes in the output layers, after convergence

4.1) GMM based classifier with 3 Gaussians per class

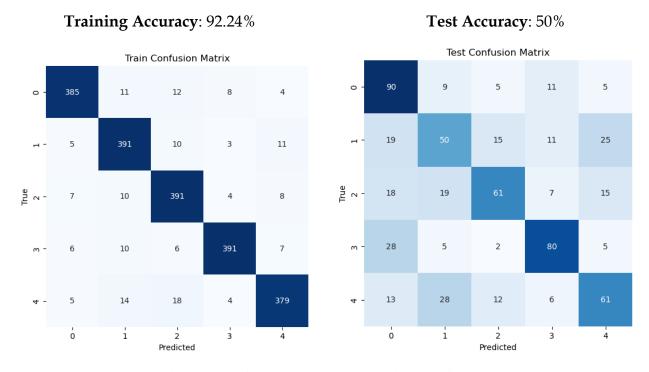
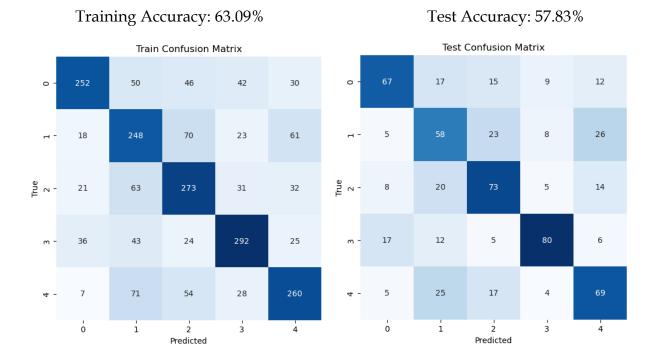


Figure 19: Confusion matrix for GMM Full covariance of Train (left) and Test (right) data



4.2) MLFFNN based classifier with 25 nodes in the first hidden layer and 15 nodes in the second hidden layer:

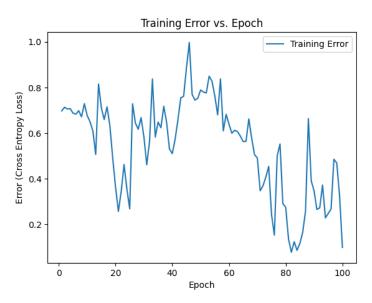


Figure 21: Training error Vs Epoch plot with learning rate = 0.01

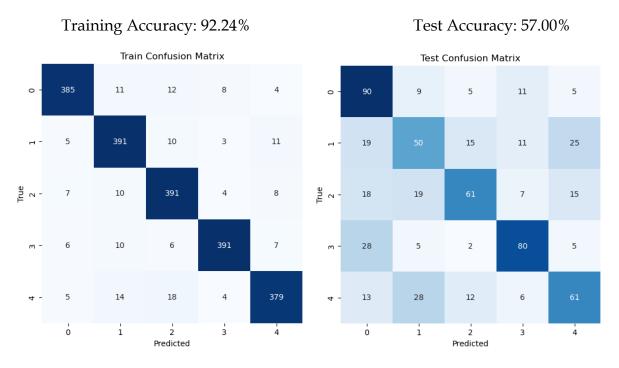


Figure 22: Confusion matrix of Train (left) and Test (right) data