ASSIGNMENT 3

CS5691 Pattern Recognition and Machine Learning

Team No. **26**

Team Members:

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1. DATASET 1

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

1.1) Training error (ξav) vs epoch plot:

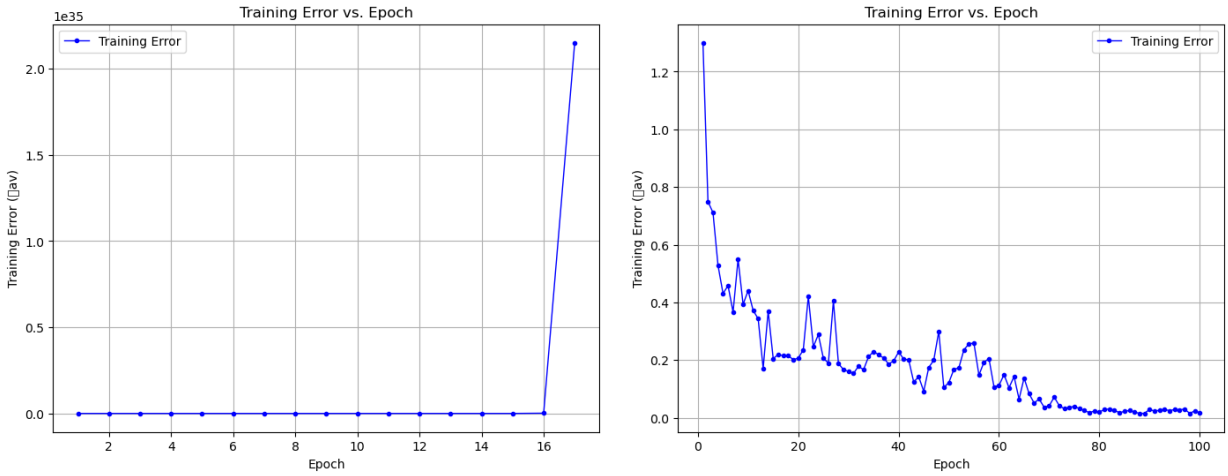


***Figure 1**: Training error Vs Epoch plot with learning rate = 0.7 (left) & 0.2 (right)*

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

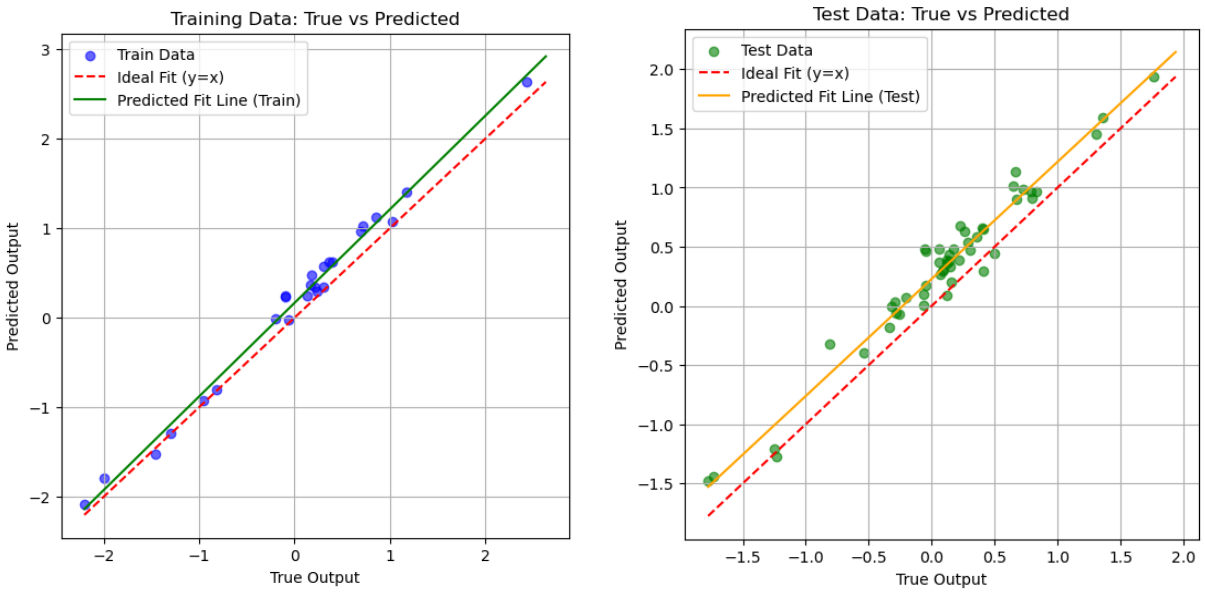


***Figure 2**: Scatter plots for Training data and testing data with learning rate = 0.2*

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:

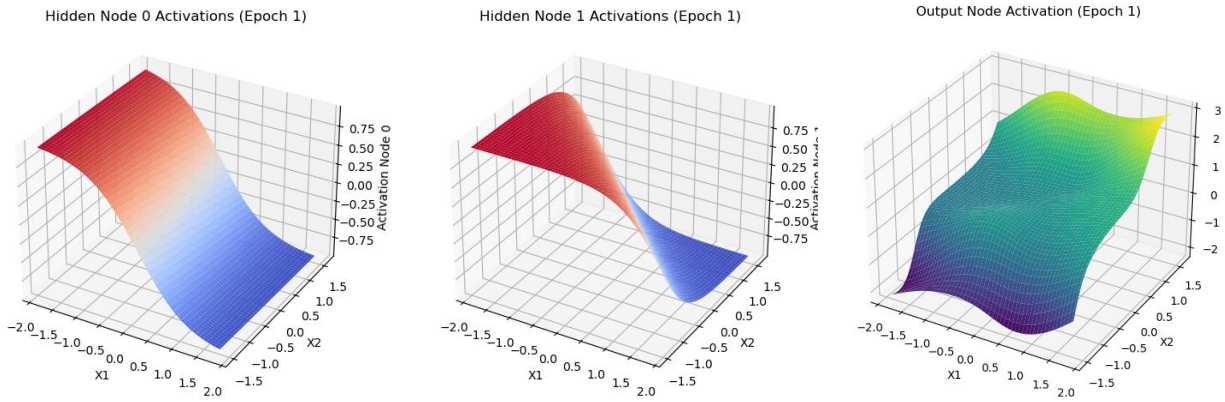


***Figure 3**: Surface plots for output of Hidden node 0 & 1 and Output Node with Epoch 1*

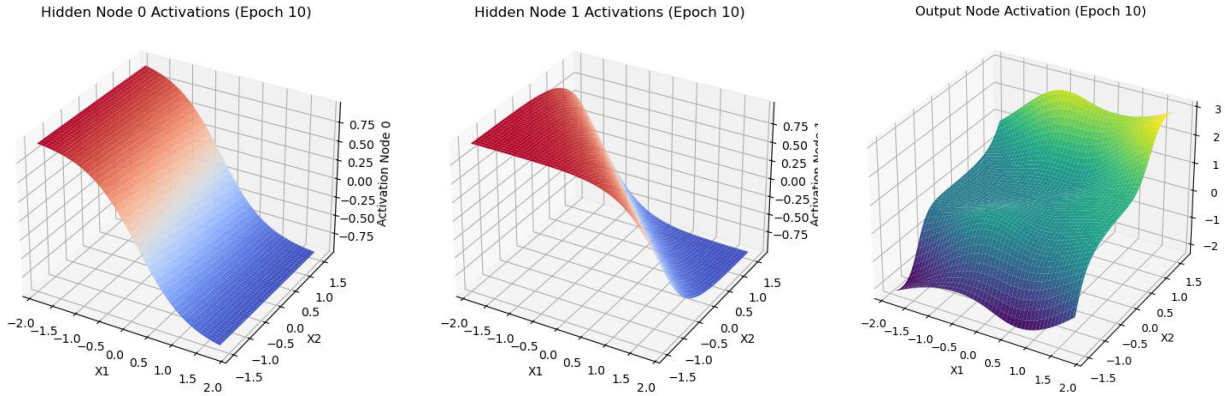


***Figure 4**: Surface plots for output of Hidden node 0 & 1 and Output Node with Epoch 10*

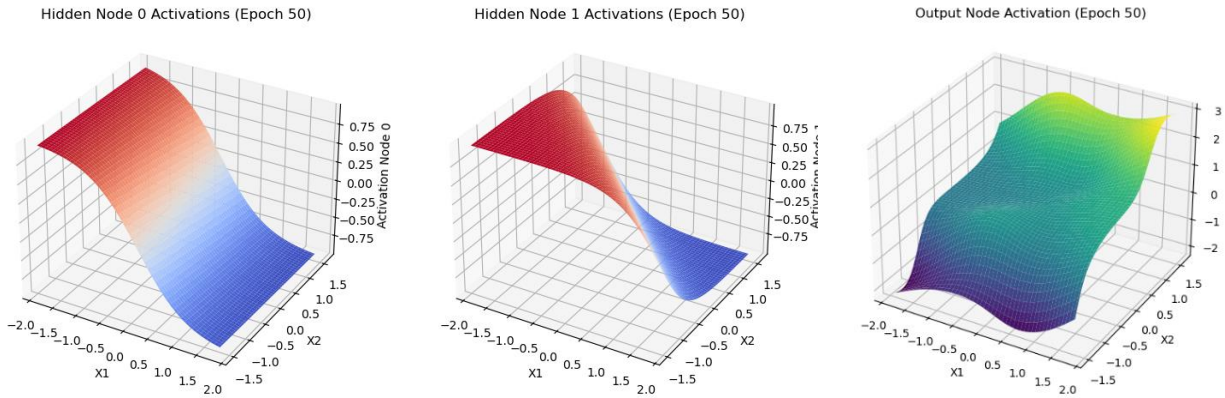


***Figure 5**: Surface plots for output of Hidden node 0 & 1 and Output Node with Epoch 50*

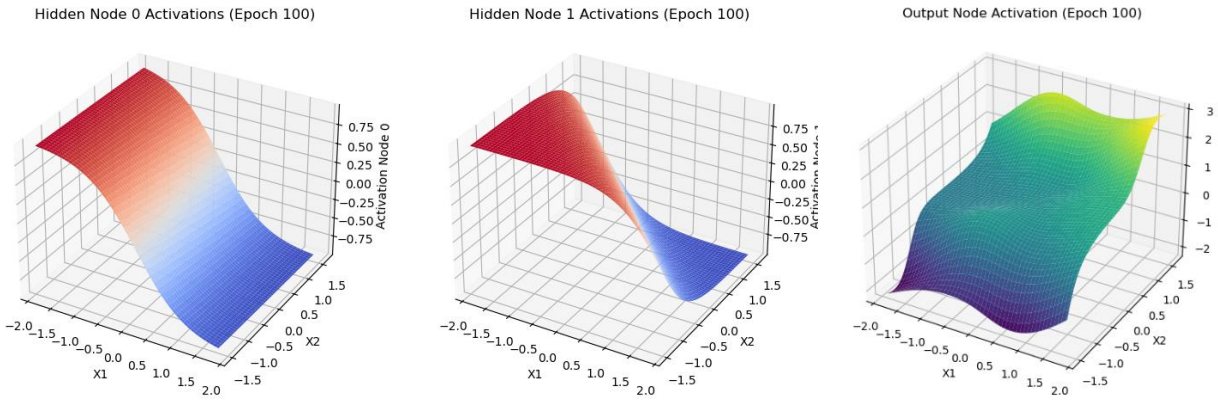


***Figure 6**: Surface plots for output of Hidden node 0 & 1 and Output Node with Convergence*

2. DATASET 2

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:

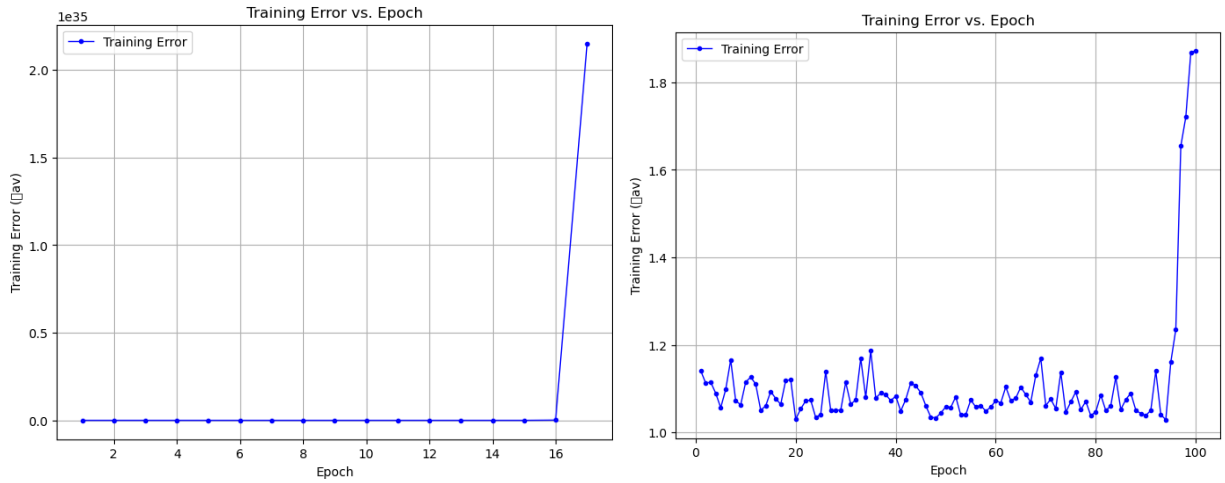


***Figure 7**: Training error Vs Epoch plot with learning rate = 0.7 (left) & 0.01 (right)*

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

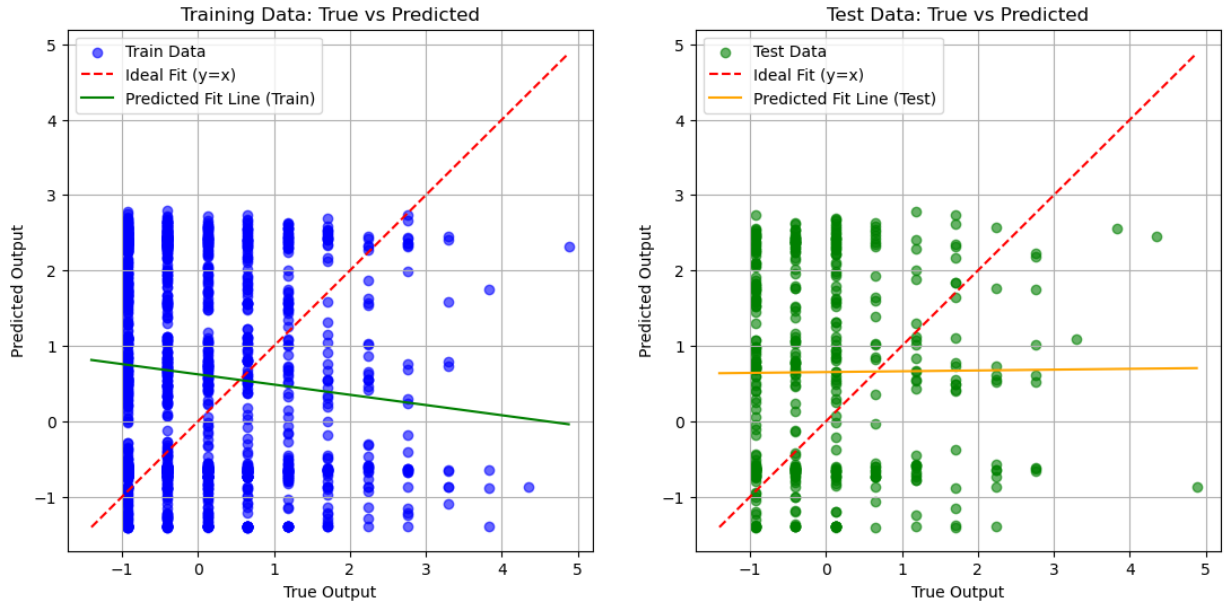


***Figure 8**: Scatter plots for Training data and testing data with learning rate = 0.01*

3. DATASET 3

3.1) GMM based classifier with 8 Gaussians per class

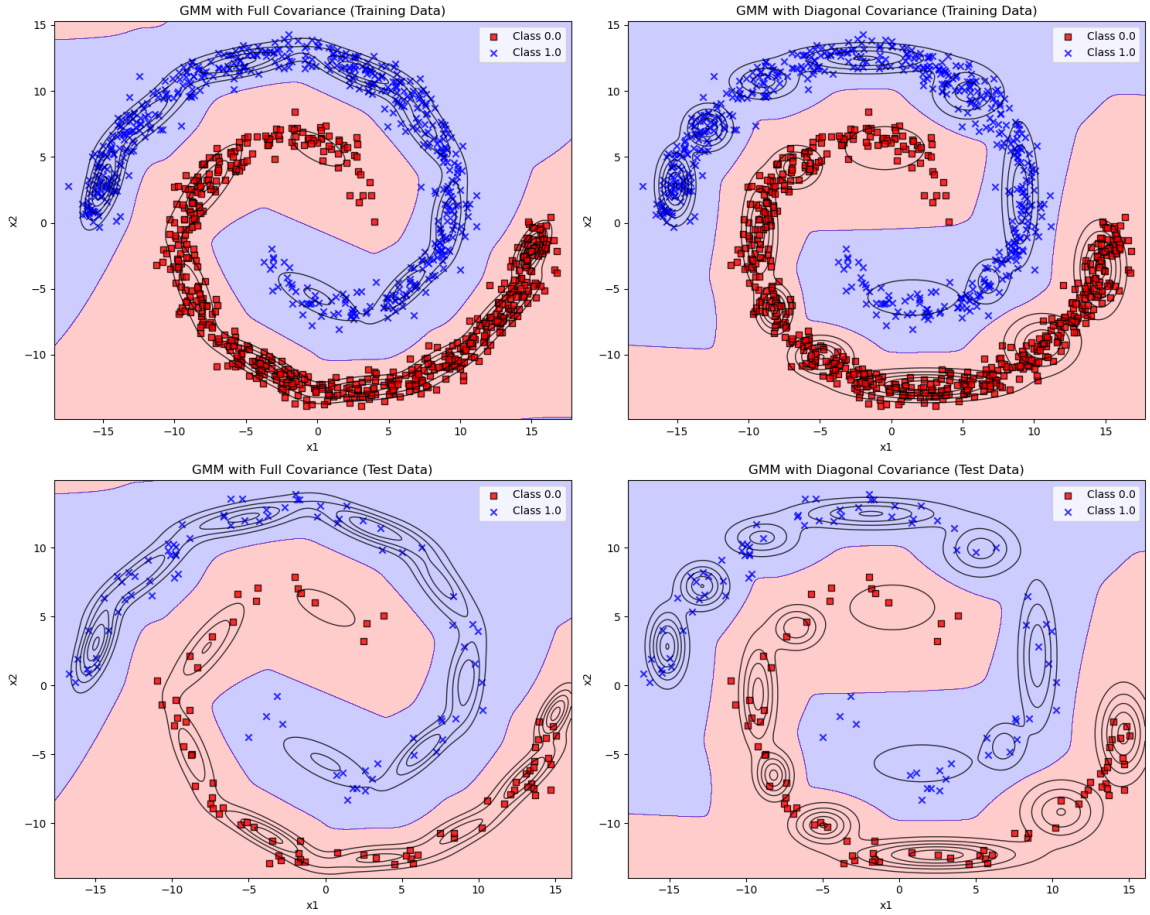


***Figure 9**: GMM with Full Covariance (Left) and Diagonal Covariance (Right)*

Train & Test Accuracy: 100%

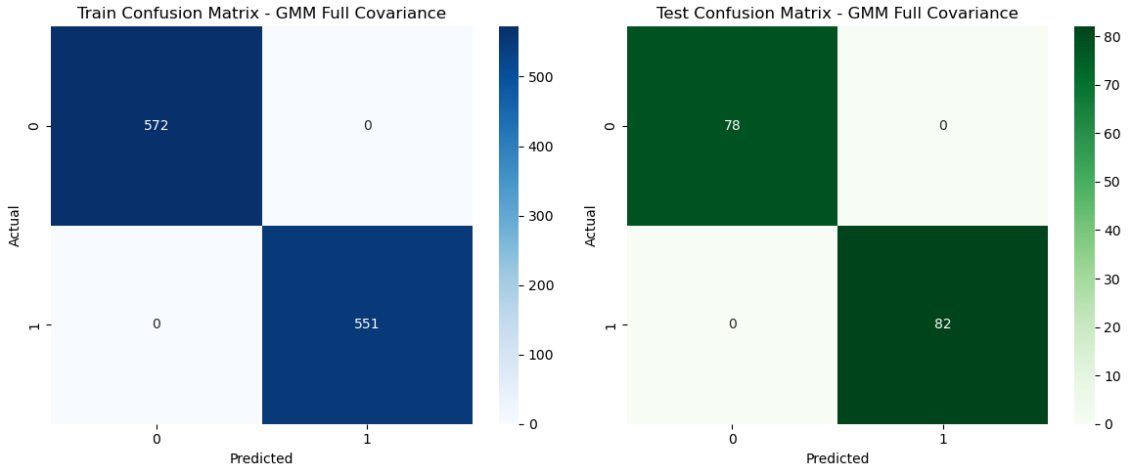


***Figure 10**: Confusion matrix for GMM Full covariance of Train (left) and Test (right) data*

Train & Test Accuracy: 100%

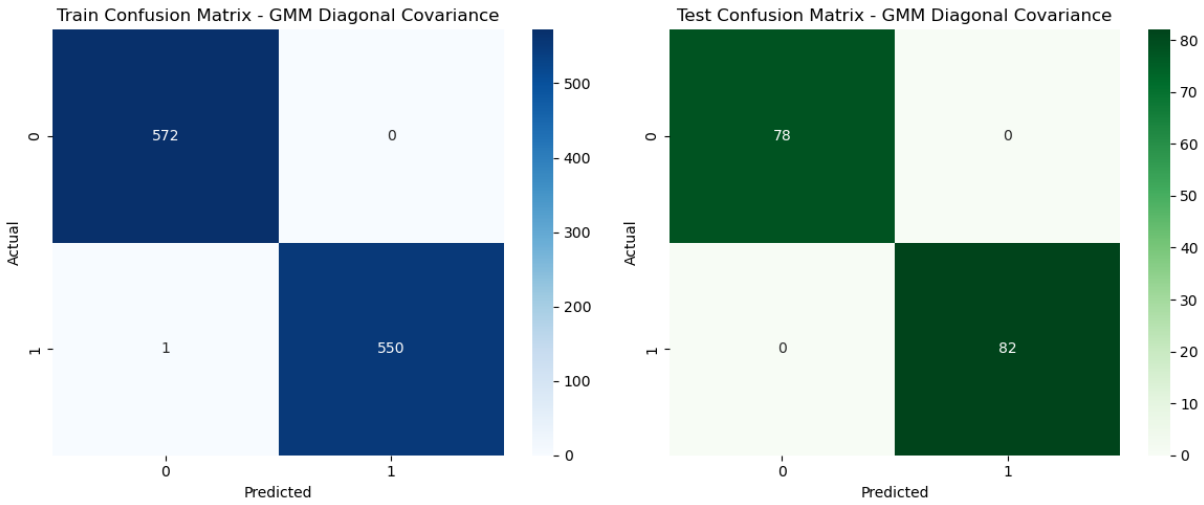


***Figure 11**: Confusion matrix for GMM Diagonal covariance of Train (left) and Test (right) data*

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

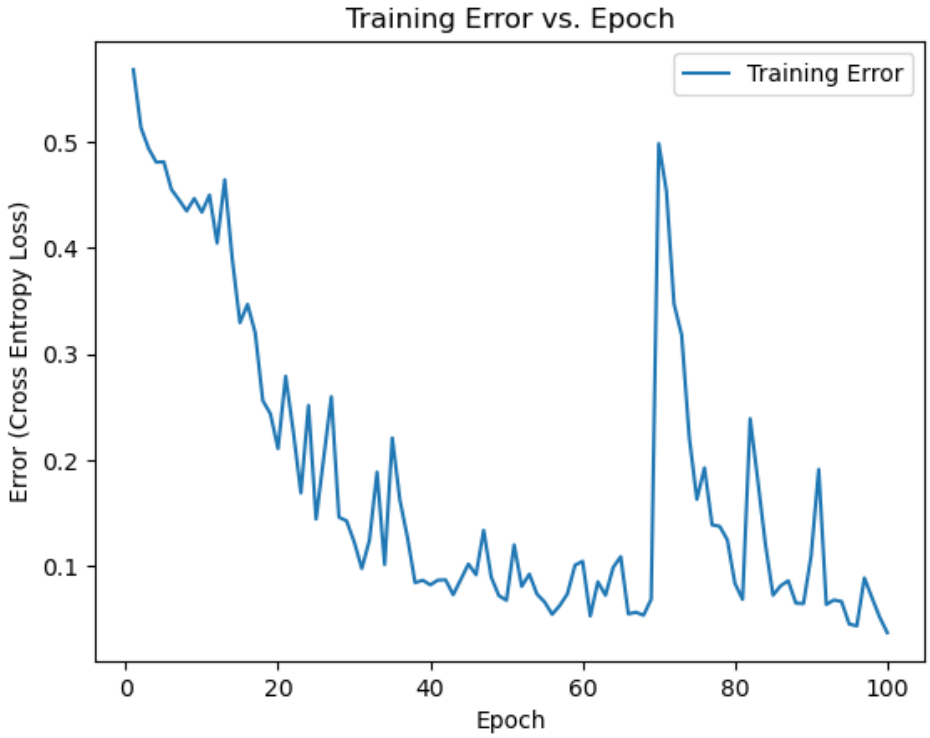


***Figure 12**: Training error Vs Epoch plot with learning rate = 0.01*

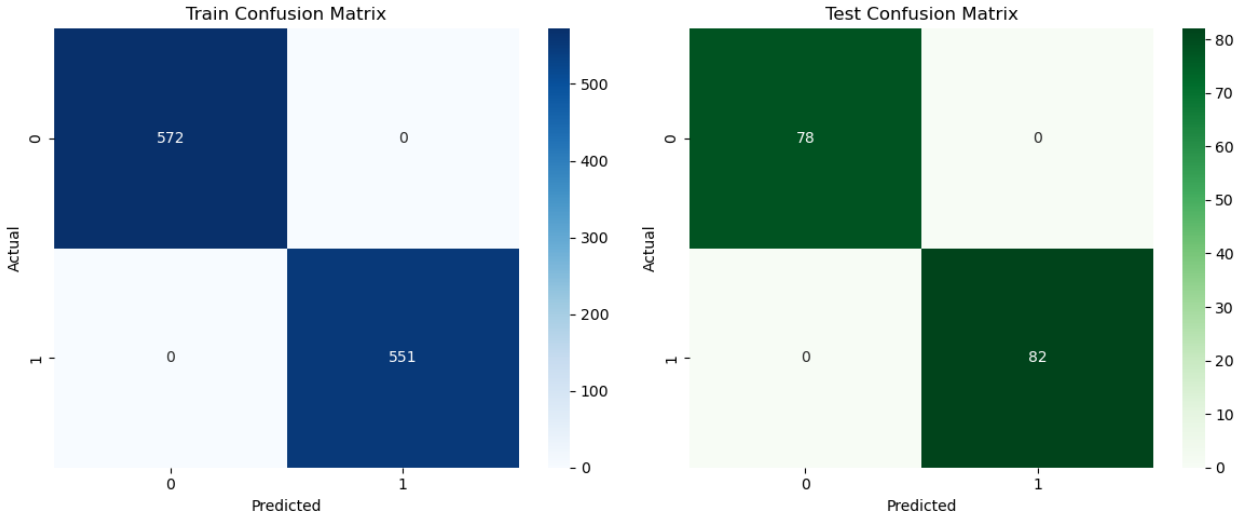


***Figure 13**: Confusion matrix of Train (left) and Test (right) data*

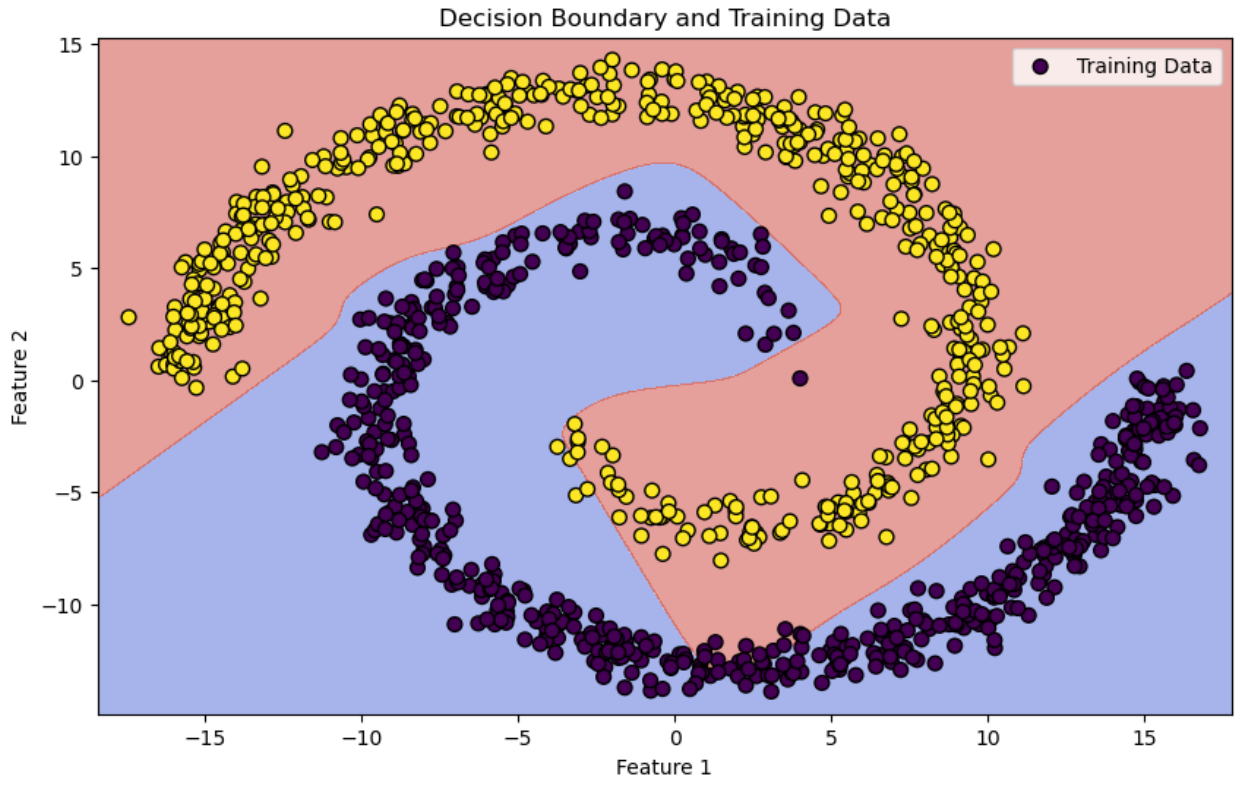


***Figure 14**: Decision Boundary of Training data*

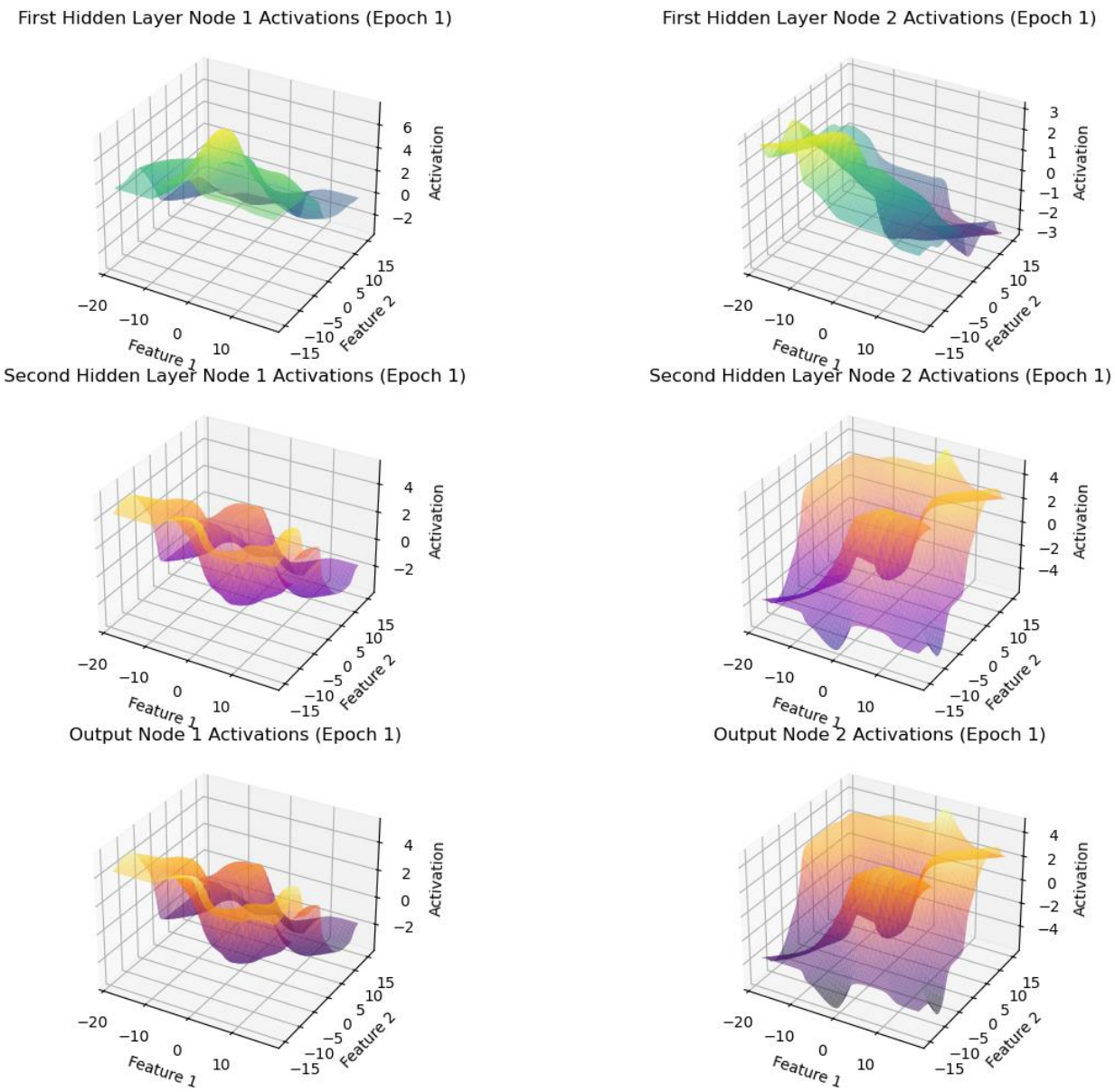


***Figure 15**: Surface plots for outputs of node 1 & 2 in the first hidden layer, node 1 & 2 in the second hidden layer and all the nodes in the output layers, after Epoch 1*

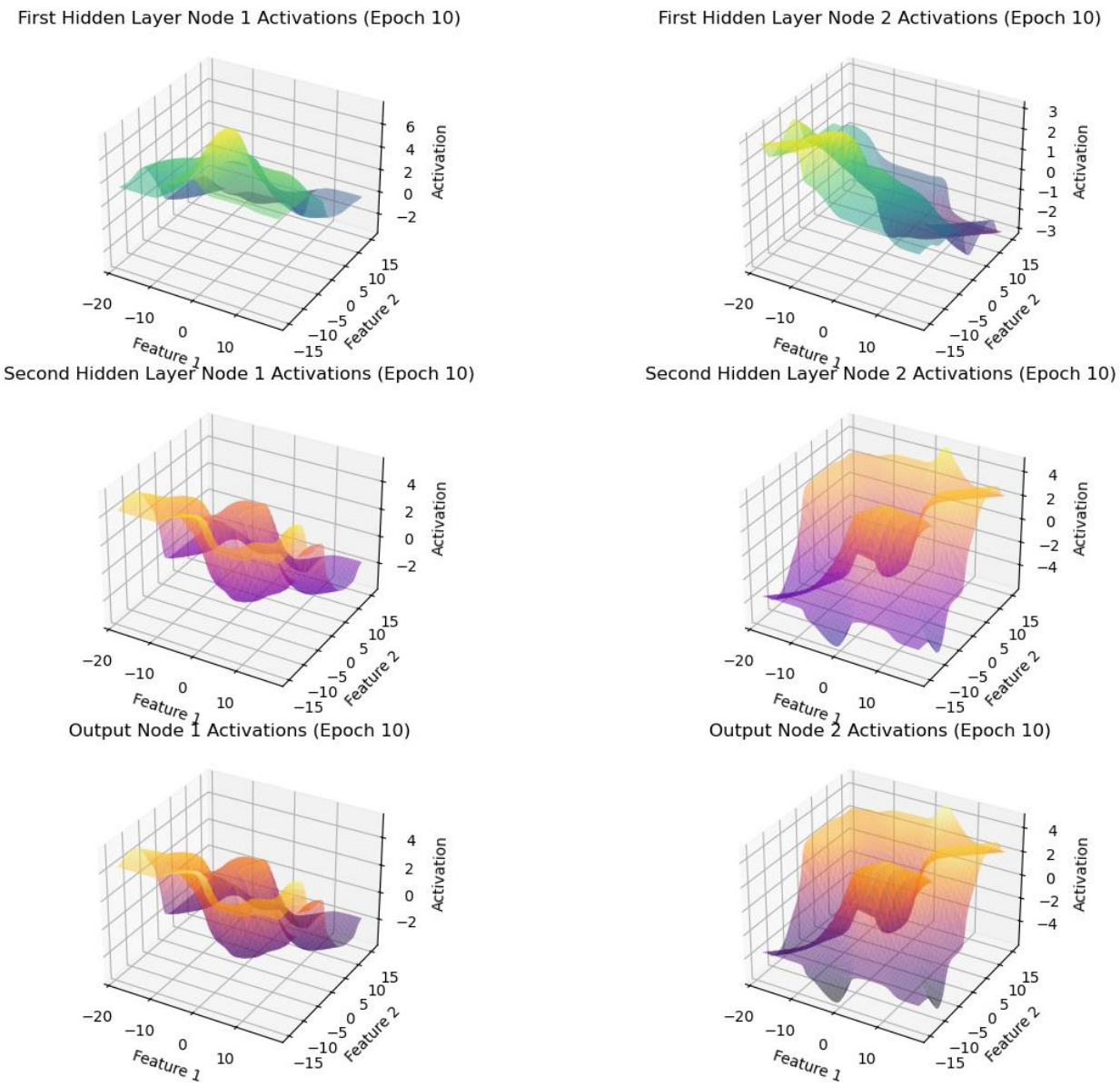


***Figure 16**: Surface plots for outputs of node 1 & 2 in the first hidden layer, node 1 & 2 in the second hidden layer and all the nodes in the output layers, after Epoch 10*

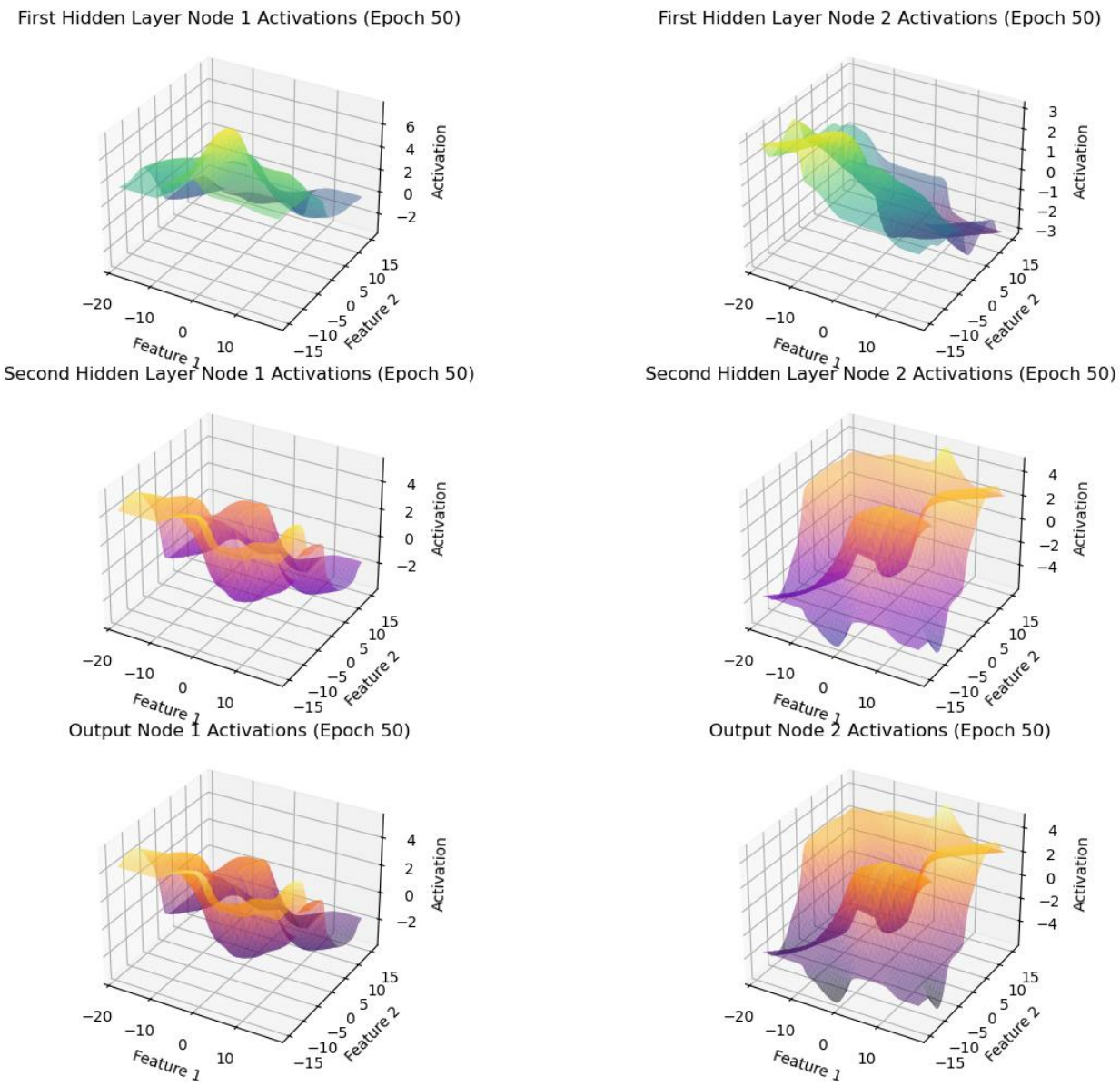


***Figure 17**: Surface plots for outputs of node 1 & 2 in the first hidden layer, node 1 & 2 in the second hidden layer and all the nodes in the output layers, after Epoch 50*

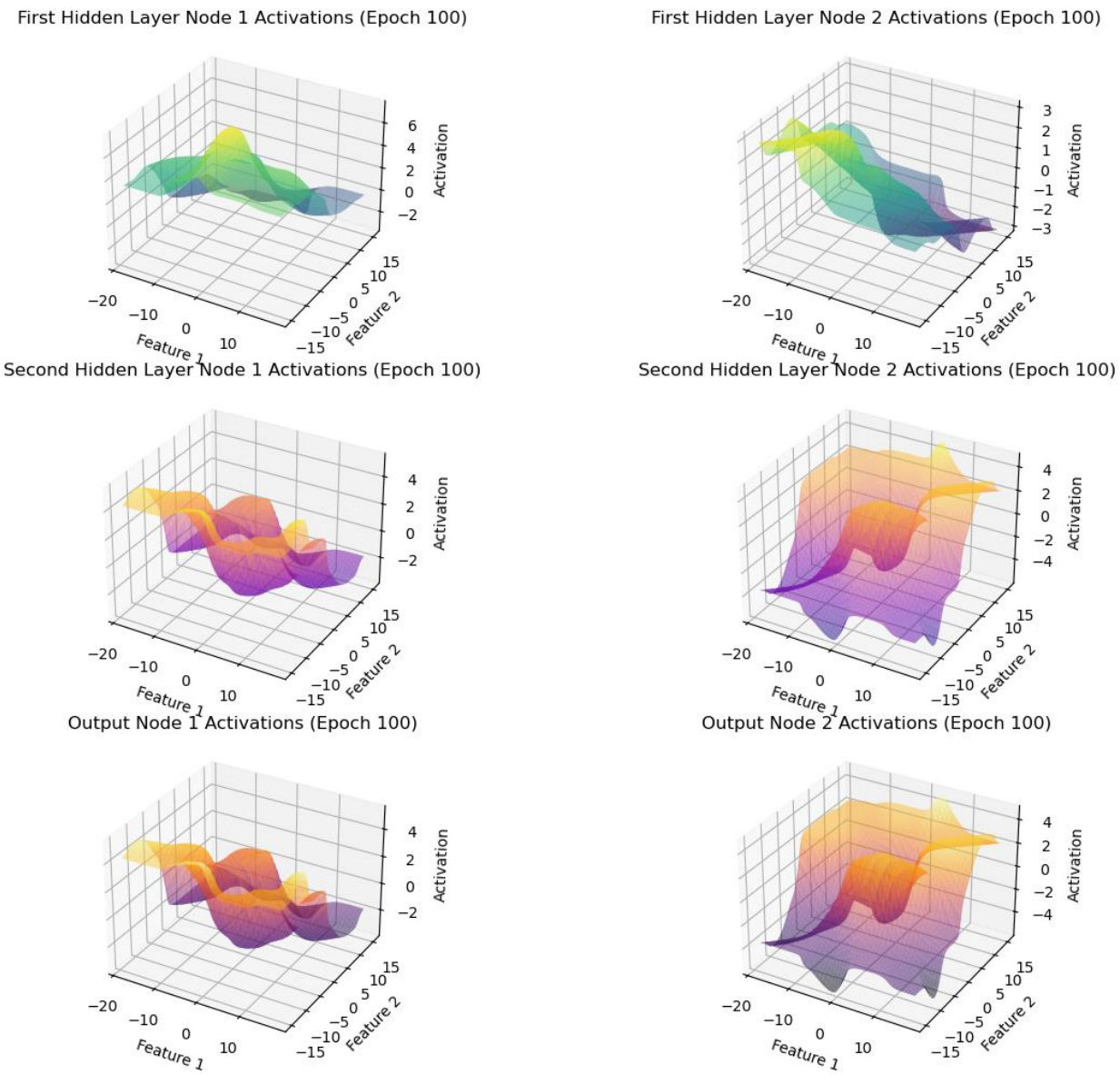
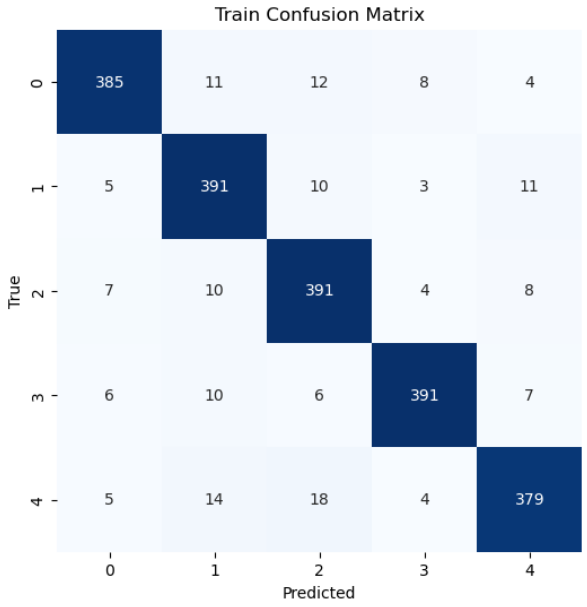


***Figure 18**: Surface plots for outputs of node 1 & 2 in the first hidden layer, node 1 & 2 in the second hidden layer and all the nodes in the output layers, after convergence*

4. DATASET 4

4.1) GMM based classifier with 3 Gaussians per class

Training Accuracy: 92.24%



Test Accuracy: 50%

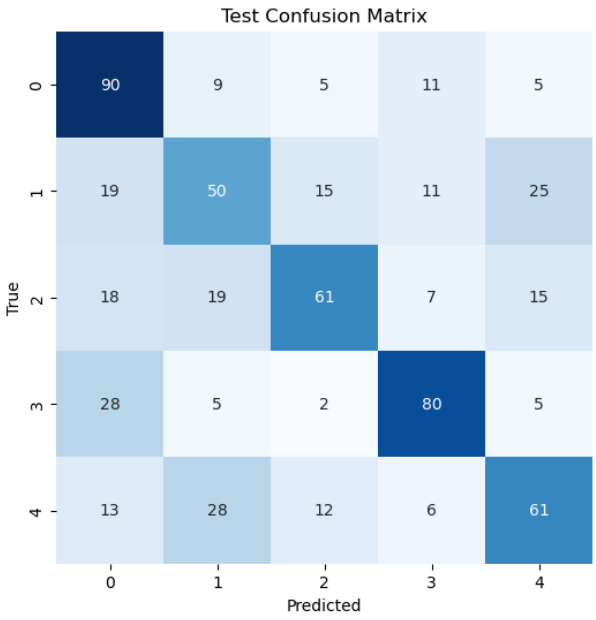
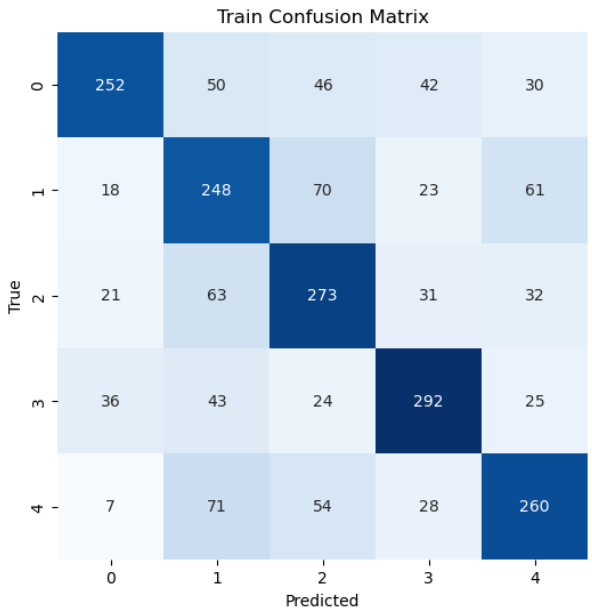


***Figure 19**: Confusion matrix for GMM Full covariance of Train (left) and Test (right) data*

Training Accuracy: 63.09%



Test Accuracy: 57.83%

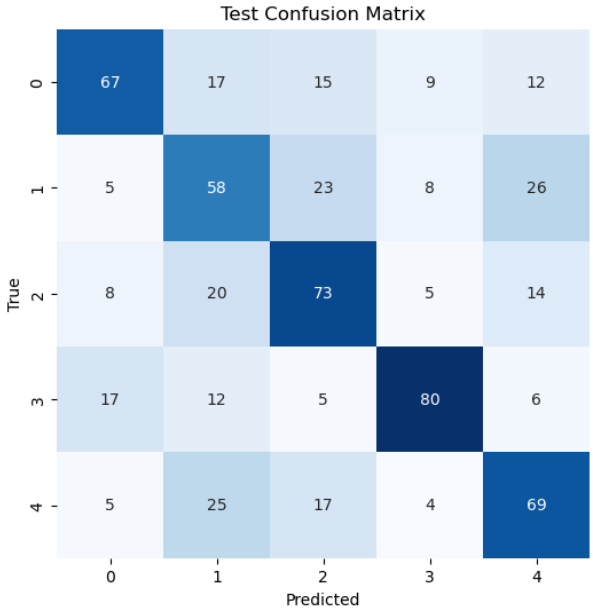


***Figure 20**: Confusion matrix for GMM Diagonal covariance of Train (left) and Test (right) data*

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

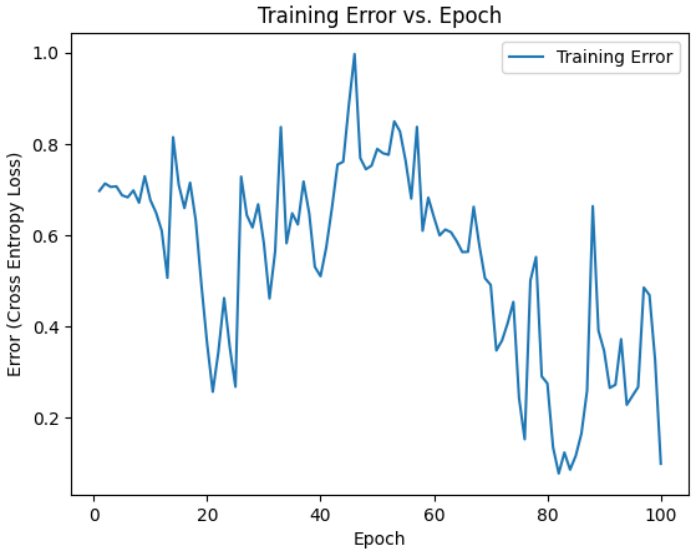


***Figure 21**: Training error Vs Epoch plot with learning rate = 0.01*

Training Accuracy: 92.24%

Test Accuracy: 57.00%

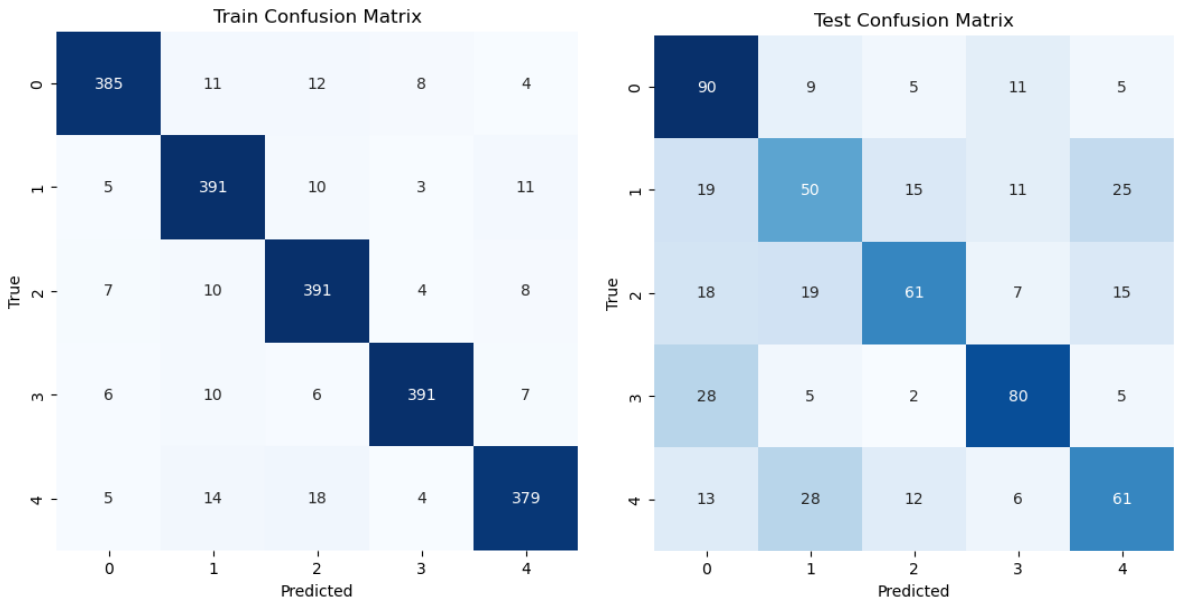


***Figure 22**: Confusion matrix of Train (left) and Test (right) data*