Summer 2018 EE690 Machine Learning Dr. L. Jololian

Assignment #3

Neural Networks

**Due Date: Thursday, July 19**

For this assignment, you are asked to implement a neural network for classifying the digits dataset from Scikit-Learn. The implementation will be done in two different ways: First, you will use the Scikit-Learn library to classify the data, then you will use your own Python implementation of neural networks, based on the class notes, to classify the same data a second time.

For each of the two implementations, you will split the dataset into two datasets: training and testing datasets. You will use the training dataset to develop the neural network model, then you will validate the model by using the testing dataset.

The dataset consists of ten (10) classes, corresponding to the 10 digits (0 through 9). Each element of the data is labeled with a number between 0 and 9. Each data element consists of 64 values corresponding to the 8x8 digitization of a hand-written digit, .

For the Python implementation of a neural network, use an appropriate number of nodes in the hidden layer. Your output should include:

1. A plot for sample of twenty values of the cost, spread evenly over the total number of iterations.
2. The Confusion Matrix and Classification Report for the test data.
3. The impact of using different activation functions on the accuracy and speed of the algorithm. for Layer 2 of the network, you can use the sigmoid function. For Layer 1 of the network, apply the sigmoid, Tanh, ReLU, and leaky ReLU. Please show a summary of your results in the form of a table and provide your interpretation of the results obtained.
4. A comparison in the use of different number of nodes in the hidden layer. Explain the results obtained.

For the Scikit-Learn implementation, your output should show:

1. The Confusion Matrix and Classification report for the test data.
2. A comparison of the results obtained in the Python implementation.