

Artificial Neural Network

Overview and Functionality of the Model

To predict labels for a series of attributes, the model employs an Artificial Neural Network. This model is used to classify from multiple classes that are not linearly separable.

The dataset is read, shuffled, and divided into training and testing split of a 7:3 ratio. The `encoding_init_y()` is used to determine one-hot encodings for the y-labels. The `stdize()` function is used to standardise the files. The biases are set to 0 and the weights are initialised from a regular normal distribution using `params_init()`. `fwd_propagate()` is used to get all node values for the network and perform forward propagation. `grad_fn()` is used to measure the gradients for the parameters using the nodes and training results. Finally, using the gradients (`grad_params`) and the learning rate (`eta`), back propagation is used to update the parameters. With the aid of the `loss_fn()` and `accuracy_calc()` functions, the iteration's loss and accuracy are measured using the expected and training labels. The estimated preparation and testing labels are collected and their accuracies are measured at the end of gradient descent using the optimal weights and biases. After that, plots of losses and accuracy vs. epochs are made. By defining the number of units in the second layer in the `hidden_sizes` array, the whole procedure is replicated for a two-layered network.

Hyperparameters:

1. learning rate(`eta`) = 0.5 (optimal), 0.05
2. iterations= 1000
3. Number of hidden layers = 1 and 2
4. No. of inputs in the input layer= 6
5. No. of inputs in the 1st hidden layer = 20
6. No. of inputs in the 2nd hidden layer 2 = 20
7. Units in the output layer=10
8. Activation function for the 1st hidden layer= Sigmoid
9. Activation function for the 2nd hidden layer= Sigmoid
10. Activation function for the output layer= Softmax

Loss and Accuracy:

When one hidden layer is used:

Training Accuracy of 75.64% is achieved

Testing Accuracy of 75.33% is achieved

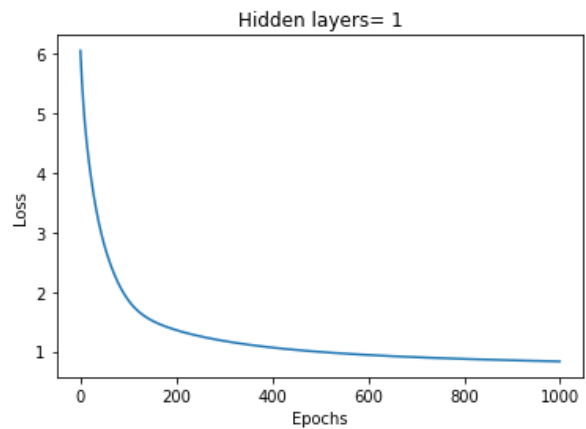
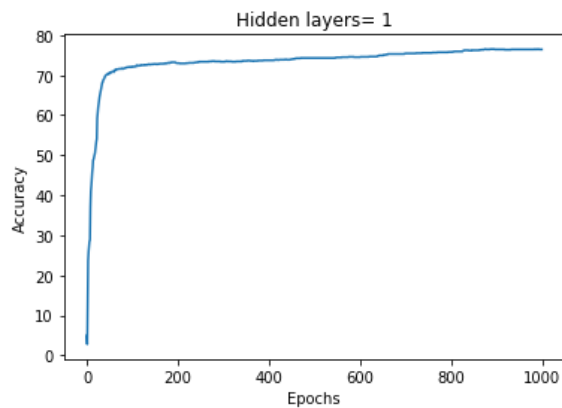
Training Loss: 0.59

Testing Loss 0.66

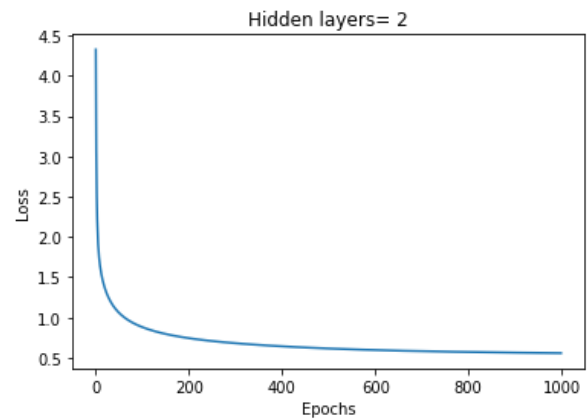
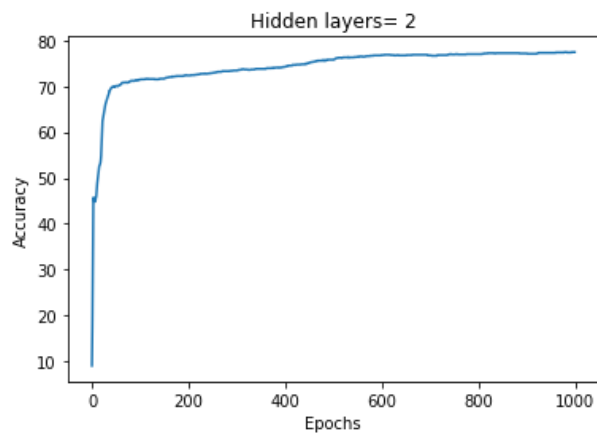
When two hidden layers are used:
Training Accuracy of 76.07% is achieved
Testing Accuracy of 73.33% is achieved
Training Loss 0.60
Testing Loss 0.69

4. Accuracy and Loss Graphs:

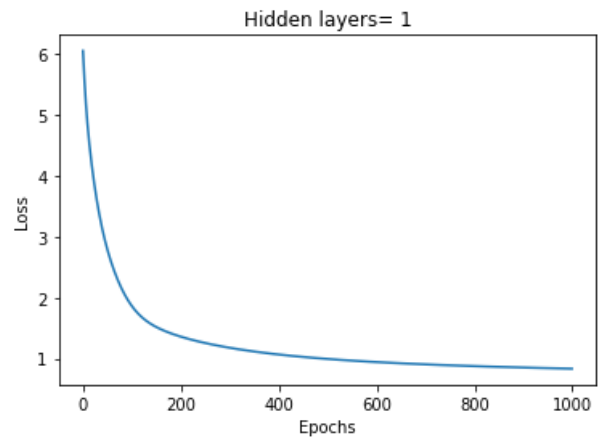
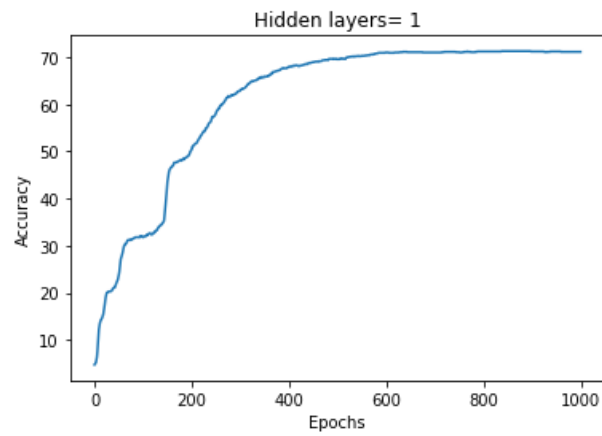
Learning rate =0.5



Learning Rate= 0.5



Learning Rate = 0.05



Learning Rate = 0.05

