CS577 Assignment 2: Sample Report

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This report has the details of the 2 Assignment programs

Problem 1–

1. **Problem statement**

   The Iris Dataset contains four features (length and width of sepals and petals) of 150 samples of three species of Iris (Iris setosa, Iris virginica and Iris versicolor). These measures were used to create a linear discriminant model to classify the species.

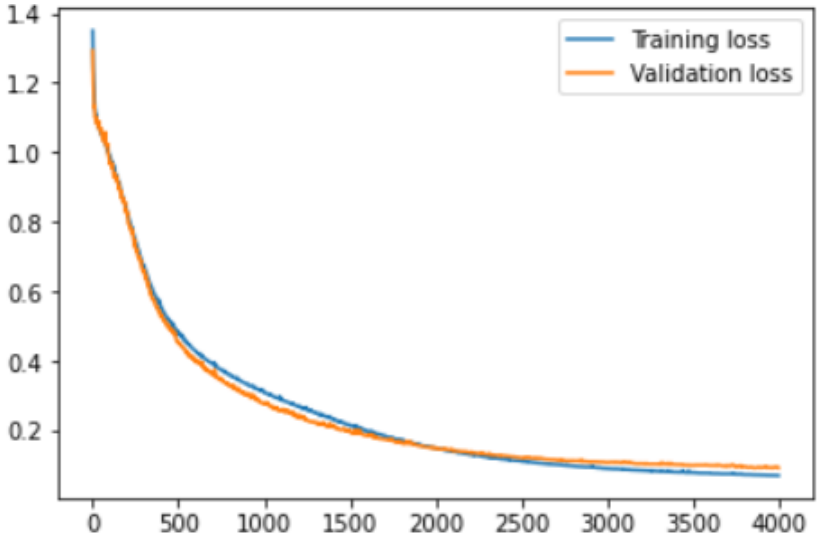
   We need to train the network using forward pass and backward pass of the backpropagation algorithm. Finally finding the accuracy and loss for testing set.

2. **Proposed solution**
   - dataset has 3 classes and 150 data.
   - We will start by downloading the data from the source and preprocessing it, making it in a format which can then easily be fed to the neural network.
   - Will use 2 hidden layers and 1 output layer with hidden layer having sigmoid activation function and output layer having softmax as the activation function and categorical_crossentropy as the loss function.
   - In the forward pass we will generate the output at each node and at each layer which will be used during the backpropagation.
   - the backward pass the start from the outermost layer it calculates the incoming gradient from the derivative of cross entropy loss to which it gives the output of the outermost layer that we got from softmax activation function.
   - Updation of weights happens after the backward pass followed by the calculation of accuracy and loss. We will continue the forward pass and the backward pass and updating the weights for the predefined epox until we get the accuracy of more than 70%.

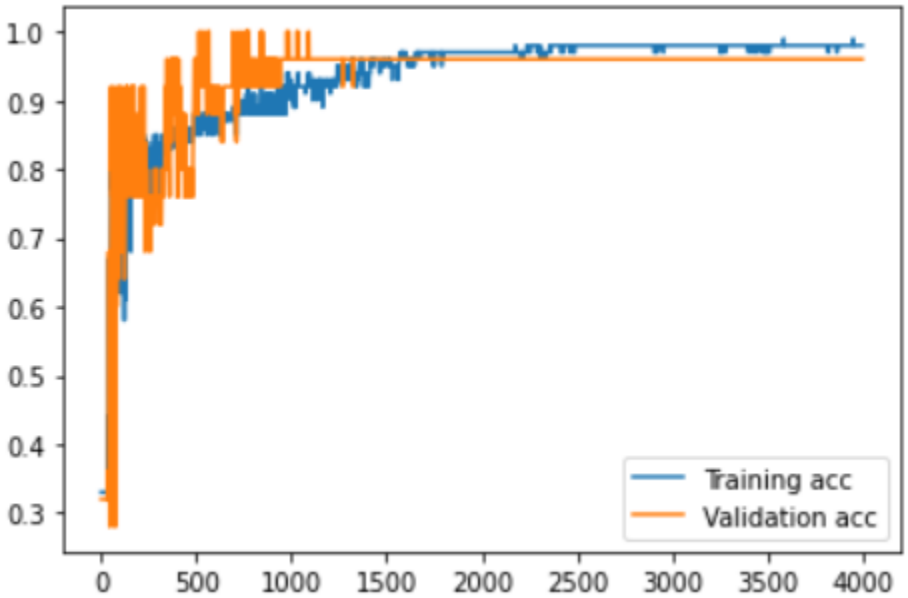
3. **Implementation details**
   - We will not be using any of the GPU libraries framework
   - Downloading the data
   - Label data into one-hot-encoded categorical format
   - We will divide the training data and two validation data, training data, testing data.
   - Using 2 hidden layers and predefining some of the hyperparameters like learning rate, number of epochs and the number of nodes.
   - Based on the accuracy we will increase the learning rate what number of epochs.
   - The outermost layer is using softmax activation function because it is a multiclass problem.

- We are writing a function to calculate forward pass, backward pass, sigmoid, softmax activation functions. As the last two calculate the cross entropy loss, calculate the gradient and updating the weights.
- Finally the map is plotted for the accuracy and loss and we run the final model on the testing set.
- Used learning rate : 0.01 and 4000 epochs

4. **Results and Discussions**
   - Testing gave 96% accuracy with 0.091 loss.



Below is the graph for Model Accuracy and Loss for 4000 epochs-



The major problem occurred do identify how many layers are needed and which activation function to use for the middle layers to get good validation accuracy.