**CS5590 APS - Deep Learning Programming**

**ASSIGNMENT 1**

**Task:**

**1. Implement the Logistic regression with new data set which is not used in class**

1. **Introduction**

In tensorflow based deep learning, data is represented as tensors(1d,2d,3d etc..) and operations on the data is defined as objects/nodes through which the data tensors flow. Input data to fed in to placeholders, fit parameters defined as variables, and an optimizer(gradient decent optimizer) model performs regression by minimizing the error/loss and fits the weights to minimum error.

1. **Objectives.**

To perform Logistic Regression on dataset from MNIST database (Mixed National Institute of Standards and Technology database) which is database of handwritten digits.

1. Approaches/Methods

Importing the data and Assigning the data as training and test set of tensors

Defining the model to fit

Using optimizers to minimize the loss function

1. Workflow
   * 1. Importing the data from MNIST database to a local folder (data)
     2. Creating the placeholder tensors for features and labels
     3. Defining the weight and bias tensors as variables
     4. Defining the model (here logits equation for logistic regression)
     5. Define Node to calculate mean of errors (loss)
     6. Define object to Reduce the error(loss) using gradient decent optimizer, learning rate should be given
     7. Define an object to initialize the global variables
     8. Initializing the global variables by running the session
     9. Input training data is taken in batches and training(run the session for optimizer object) is performed over all batches for n\_epoch number of times, this adjusts the weights and bias decreasing the error(loss) and increasing the accuracy of the model gradually
     10. Load the test data for features and variables
     11. Run the session to evaluate the model outputs and error(loss)
     12. Compare the predicted outputs with actual outputs for the test data
     13. From correct predicted values calculated the accuracy of the model fit.
2. Datasets

Data set is imported from MNIST database which is database of hand written digits. Each image is size 28\*28pixel which is flattened to 1D tensor of 784 scalar values. Output is 10 classes of digits from 0 to 9, they are labeled as one hot vector of size 10.

*here each image(28\*28pixel) is loaded into  
# 1d tensor of size 784)  
#dependent variable is 10 classes(1 to 10) hence one hot vector of size 10*

1. Parameters

Model Parameters

learning\_rate = 0.005 #It is the rate at which gradientdecent algorithm trains the model parameters(rate of weight update by minimizing the error gradient with respect to weight gradient)  
batch\_size = 128 (input is given in batches)  
n\_epochs = 100 (number of times the training is done

model fit para meters are tensor of weights(w) and bias(b), they are defined as variables whose value updated with the training.

1. Evaluation & Discussion

* Input data is 1D tensor of size 784, output is 10 labels for digits form 0 to 9 (one hot encoded)
* Logistic model is used, tensor of weights and bias are trained with the training data.
* Training is done in 100 epoch cycles to decent to the minimized solution, learning rate is taken as .005.
* Evaluating the test data on fit model accuracy observed is .916

Accuracy 0.916

Accuracy can be increased further by using multilayer perceptron models rather than single layer perceptron model used here.

1. Conclusion

Logistic Regression is performed on the MINST data base of handwritten digits. Accuracy of the model tested with test data is 0.916. Flow graph from tensor board in shown bellow.

