Lab Assignment 04

Total marks: 15

Instructions:

1. Complete the entire code provided in the template, make sure everything runs, and the desired plots show up. You will be expected to submit this IPython notebook during submission
2. You can use SciPy library for Optimization.

1 Multiclass Classification using Neural Networks [10 Marks]

Apply the forward and backward propagation algorithm discussed in the lab session to classify the Fashion-MNIST image data. Fashion-MNIST is a fashion product image dataset comprising of 10,000 − 28 × 28 training images with 10 categories of fashion products. Figure 1 shows all the labels and some images of each label in the Fashion-MNIST dataset.

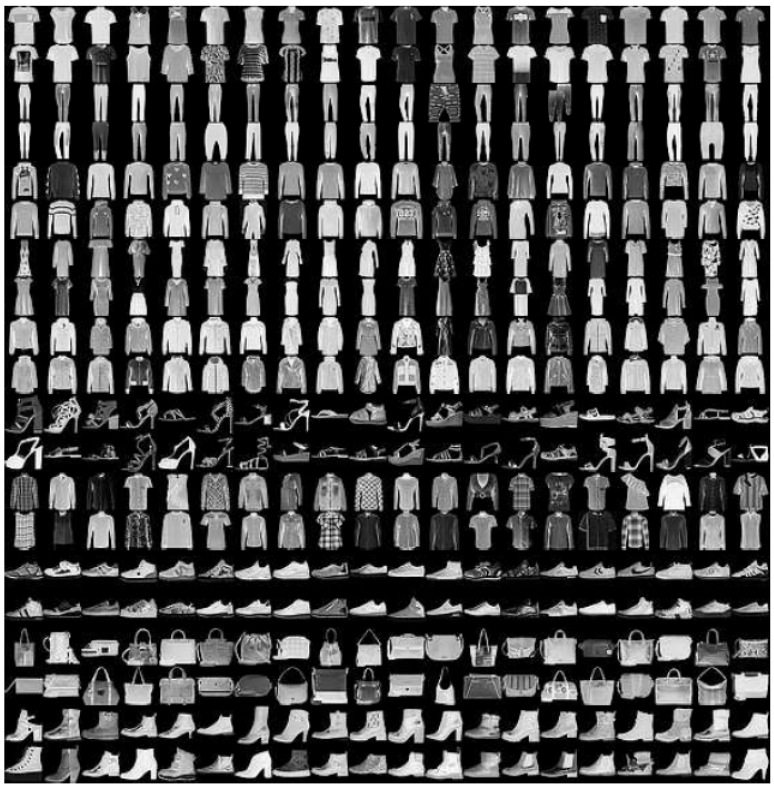
Label	Description	Examples
0	T-Shirt/Top	
1	Trouser	
2	Pullover	
3	Dress	
4	Coat	
5	Sandals	
6	Shirt	
7	Sneaker	
8	Bag	
9	Ankle boots	

Figure 1: Fashion-MNIST dataset.

Carry out the following tasks as assignment problem:

1. Inspect and plot some portion of the training data. Segregate the data into two separate variables consisting of 'feature matrix' and corresponding 'labels' (first column of the data). Normalize the feature matrix data. Plot some example images along with their descriptive labels.

2. Classify the dataset using neural networks, with two hidden layers. The number of nodes in the hidden layers is your choice, as discussed in class. Calculate the optimized weights and biases and training set accuracy for the model (take regularization parameter $= 0.1$) [4 Marks]

3. Implement **sigmoid** and **ReLu** activation functions and see which performs best. Add a **SoftMax** activation for the output layer for both cases. [1 Marks]

4. Apply the trained model algorithm on the normalized test dataset and predict the testing accuracy of the model for both sets of activation functions (Use the optimized weights calculated using training data). [2 Marks]

5. Use the test data to plot few images along with the model-prediction labels/classes. [1 Marks]

6. Compare how the two **NNs** fare in terms of prediction accuracy for the same number of optimisation iterations and comment what you can conclude from that. [1 Marks]

7. Plot the evolution of cost function over optimization iterations [1 marks]

2 Binary Classification with Nonlinear Decision Boundary

1. Use the following code snippet to generate a 'Binary Classification' dataset

```
import sklearn
import sklearn.datasets
X, y = sklearn.datasets.make_moons(500, noise=0.30)
```

2. Write a Neural Network code to do Binary Classification using Non-linear Logistic Regression and plot the decision boundary with scattered data-points in the same plot. [5 marks]