

Lab Assignment 03

Total marks: 10

Instructions:

1. Submit the separate codes for the two datasets provided.
2. You can use SciPy library for Optimization.

1 Multiclass Classification [10 Marks]

Apply the one-vs-all multiclass classification algorithm to classify the MNIST Handwritten Digit Classification Dataset. The MNIST dataset consists of images of handwritten digits comprising of 5,000 – 20×20 images with 10 categories of labels. Figure 1 shows all the labels and some images of each label in the MNIST Handwritten digit dataset. Divide the whole dataset into training and test dataset as 70% and 30% of the actual dataset.

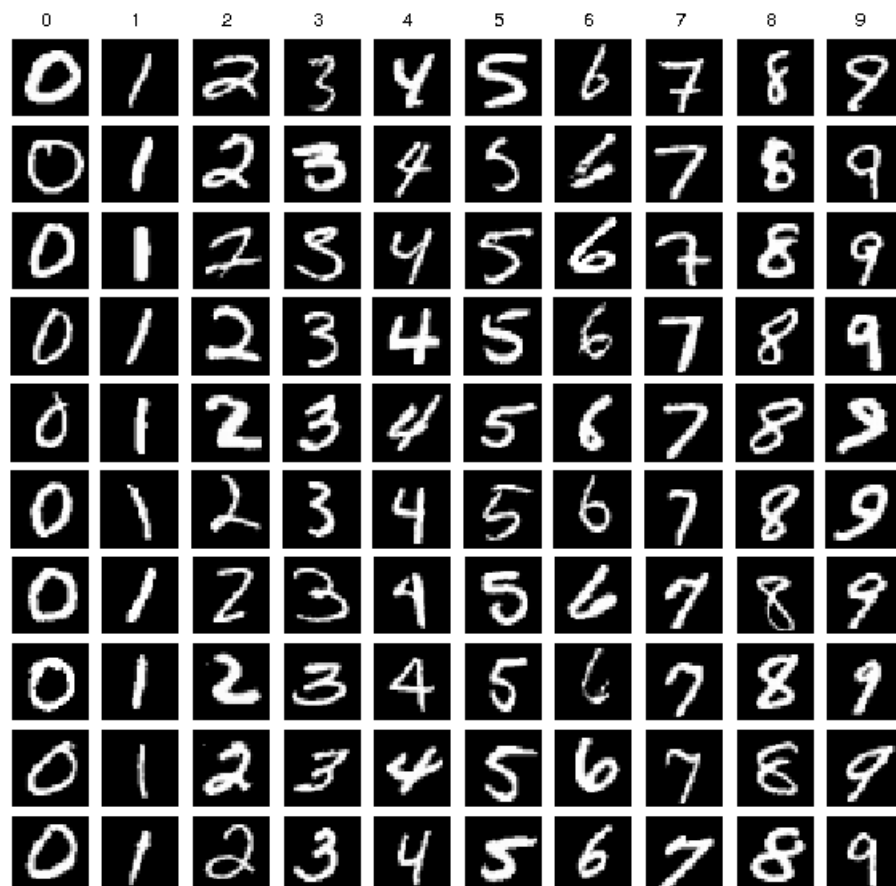


Figure 1: MNIST database of handwritten digits.

Carry out 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’. Plot some example images along with their descriptive labels. [1 Mark]
2. Classify the dataset using one-vs-all multi-class classification algorithm and calculate the optimized weights and training set accuracy for the model (use Conjugate Gradient algorithm for optimization). [4 Marks]
3. Plot the cost history (J) vs number of iterations for all the class labels in a single plot. [1 Mark]
4. Apply the trained model algorithm on the test dataset and predict the testing accuracy of the model. [1 Mark]
5. Use the test data to plot few images along with the model predicted labels/classes. [1 Mark]
6. Apply the softmax classification algorithm on the Fashion-MNIST dataset without using any package. Fashion-MNIST is a fashion product image dataset comprising of 10,000 – 28×28 training images with 10 categories of fashion products (see Fig. 2). Also, compare the testing accuracy using the one-vs-all and softmax algorithms. The training and testing datasets are provided in the files titled ‘fashion-mnist_train.csv’ and ‘fashion-mnist_test.csv’, respectively. Normalize the feature matrix data (the same way as you did in Assignment for Logistic Regression) before using it in the algorithm. [2 Marks]

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 2: Fashion-MNIST dataset.