ELL888: Assignment 1 - Understanding the core mechanics of Deep learning

January 16, 2018

1 Introduction

The goal of this assignment is to get a basic understanding of building a (Shallow/Deep) neural network. One has to hard-code the core work-horses of DNN and use them on a dataset.

1.1 Problem description

1. Task - You are expected to solve a Multi-class classification task using neural networks from scratch.

2. Data - EMNIST dataset - scanned images of hand-written Roman alphabets downloadable at EMNIST. EMNIST dataset includes the grayscale images of dimension 28×28 english alphabets (26 classes) and numbers (10 classes).

3. Problem description - Choose three non-overlapping alphabets each from your names (a team of 2) and train a multi-layer perceptron or a feed-forward network (not any other architecture) to classify the images from EMNIST as belonging to one of the six classes (alphabets from your names).

2 Deliverables

1. Hardcode the vanilla backpropagation algorithm for a neuron with some activation fucntion (40 marks).

2. Build and train a feed forward neural network with a single and multiple hidden layers.

3. Add Lasso (L1) and Ridge (L2) regularization to your objective function (20 marks)

4. Add Batch normalization and dropout layers (20 marks)

5. Create a report detailing your findings that should contain (but not limited to) the below list (**WE NEED CODE TOO!!**)(20 marks)

2.1 Report contents

(a) A brief description of your approach and general findings.

(b) Plots showing the train and test error (using standard metrics) with at least two-types of objective functions and various activation functions.

(c) Plots showing the train and test error with and without regularizations.

(d) Plot showing the train and test error with and without batch norm and dropout.

(e) IMPORTANT - All plots should have a decription summarising your findings.

(f) A summary report for the entire assignments.

3 Setup and requirements

For this assignment, all implementations should be in Python (version 2.7). You may have to use NumPy package of python and vectorise the calculations (hint!). You should **NOT** be using any frameworks (Theano, Keras, Tensorflow, Caffe, Torch etc.) for any tasks. The idea is to make your learn to live with the hard-core workhorse algorithms of deep learning.

Use train data for training and test data for evaluation. Usage of test data for training will result in 0 marks.

4 Submission

Submit the Python files and the report (in .pdf format).