Advanced PRML

Assignment 1   Due Date: August 23, 2017

Note: Do not plagiarise the assignment solution.

Practice Question: Complete the tasks provided on the site: https://github.com/jrubin01/google-deep-learning-class/blob/master/1_notmnist.ipynb. The whole task is divided into six problems. Solve these six problems.

Q2: Regularization is a widely used technique in deep learning to prevent the model from overfitting. Some of the widely used regularizations are L1, L2, and trace norm. Implement these techniques in autoencoder. Download the python script from: https://github.com/siddharth-agrawal/Sparse-Autoencoder-Linear and complete the following tasks using the notMNIST dataset:

2.A) Derive the backpropagation rule for L1, L2, elastic net ($\lambda1$ x L1 + $\lambda2$ x L2), and trace norm (The trace of a matrix is the sum of the eigenvalues) for autoencoder.   **2+2+3+3 marks**

2.B) Implement these regularization in provided sparse autoencoder python script.
Do not use theano grad or auto grad function to calculate gradient of the cost function. Derive your backpropagation rule for the mentioned regularizer and update the backpropagation rule for the autoencoder.   **2+2+3+3 marks**

Q3: Download the implementation of variational autoencoder from https://github.com/zxie/vae and train the network. Use the trained network to visualize random samples from learned generative models of MNIST for 2-D and 5-D latent space. Repeat the process when latent variables have Gaussian and Bernoulli distributions.   **5 marks**

Bonus Question: Implement another suitable distribution for latent variable and analyse the performance with Gaussian, and Bernoulli distributions.   **10 marks**