

Assignment-2

Submission Deadline: October 24 11:59 pm

Classification – Hand-crafted, Neural network

Problem 1

a) MNIST is a handwritten Digit Classification dataset that contains 60,000 training and 10,000 test images. Using this dataset, build a three-layer feedforward neural network. Use 10K images from the training set as validation data. The two hidden layers have a dimension of 500 each. Using a suitable loss function, train the network for 250 epochs, and report the classification accuracy on test data. Do not use regularizations. Plot the error and classification accuracy on both training and validation data over the epochs. Justify the loss used to train the network. Also, normalize the data appropriately.

b) Repeat the above experiment, but train the network with the following regularizations:

- L2 regularization
- Dropout
- Early stopping

Compare with the results in the previous experiment and detail your observations after adding the regularizations. Note: No need to implement them on your own; the software framework (Tensorflow/Pytorch) typically provides implementations for L2 regularization and dropout. Early stopping is employed during training, so you need to tune your training code accordingly.

Problem 2

Train a Convolutional Neural Network (CNN) for image classification on the CIFAR-10 dataset. Try different network configurations and parameters:

- Number of convolutional (Conv) layers
- Fully connected (FC) layers
- Number of filters in different layers
- Max-pooling
- Number of epochs
- Stride
- Activations

Study the effect of these network parameters and configurations on the classification performance. Try to improve the performance as much as possible by modifying these parameters. Please present the results of such a study in the form of table/plots that show the classification performance as a function of these parameters. Justify the activations used in the network. Also, look at some of the images that are misclassified and see if there is an explanation for such misclassifications.

Suggested Frameworks: Tensorflow/Pytorch.

You can use GPUs available from IITD-HPC or Google Colab.

Request for GPU on HPC:

http://www.cc.iitd.ac.in/CSC/index.php?option=com_content&view=article&id=153:hpc-cluster&catid=1:latest-news

Setup HPC:

<http://supercomputing.iitd.ac.in/?access>

How to submit jobs:

<http://supercomputing.iitd.ac.in/?pbs>

Do not submit jobs on login nodes. The hpc account will be blocked if run your jobs on login nodes.

You can use as colab as well.

<https://colab.research.google.com>

You can take help from resources available online. But, do not copy code. Strict penalty will be imposed if the code is found to be similar.

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Thanks.

Regards,
ELL784 course TA's