

# DSE 316/616: Deep Learning

## Assignment 1

### Submission Policy and Requirements :

- Any kind of plagiarism is not accepted. We will strictly follow institute policies for plagiarism\*
- Recommended programming languages: Python + PyTorch / Tensorflow (use of Keras lead to zero points)
- Do cite references (if used any)
- Submission should include working code for the questions asked and a report to show the analysis of results in each of the parts.

### Assessment criterion:

The assessment will be done on the basis of the following components:

- Working codes
- Analysis and clarity of results (drawing comparisons across different parts) and clarity of the report
- Understanding the theoretical concepts and the choice of hyperparameters

### Guidelines for Submission:

- A single report(pdf) for all questions
- Mention all the relevant results, comparisons as asked or wherever required for better understanding of the results
- A single zip file containing the report, codes and readme if required
- Name the file with roll number, example *rollnumber<sub>a</sub>1.zip*

### Question 1 (50 points)

Implement two layer back propagation neural network from scratch [10 points] (don't use any functions from PyTorch / Tensorflow) on [Letter Recognition dataset](#) with following configurations:

- A. Vary learning rate [5 points]
- B. Vary number of epochs [5 points]
- C. Xavier weight initialisation [5 points]
- D. Use Adam optimizer [5 points]
- E. Using activation functions: tanh, ReLU [5 points]

Use cross-entropy loss[5 points]. Plot the loss and accuracy curves on the training and test sets[10 points]. Find the best configuration for your network (a combination of best learning rate, best number of epochs, and activation function), support your claim.

### Question 2 (50 points)

Construct following CNN architectures [20 points]. Use the CIFAR-10 dataset for all the analysis.

- A. Conv-Pool-Conv-Pool-Conv-Pool-FC
- B. Conv-Conv-Pool-Conv-Conv-Pool-FC
- C. Conv-Pool-Conv-Pool-Conv-Pool-FC-FC

FC refers to Fully Connected Layer here, provide with the following analysis:

- A. How does changing the network size change the accuracy? [10 points]
- B. Experiment with different sizes of pooling and do a detailed analysis of pooling size on the network.[10 points]
- C. How the presence of one or more fully connected layers changes the accuracy. [10 points]