January-May 2024 Semester
CS6910: Fundamentals of Deep Learning
Programming Assignment I

Date: **February 26, 2024**
Deadline for submission of PDF file of report: **Monday, March 18, 2024**

Task 1: Comparison of optimization methods for classification on Image dataset 1

- Model: MLFFNN with 2 hidden layers and tanh activation function
- Loss function: Cross-entropy
- Mode of learning: Pattern mode
- Stopping criterion: Change in average error below a threshold
- Weight update rules: (1) Delta rule, (2) Generalized delta rule, (3) AdaGrad, (4) RMSProp, (5) AdaM
- Use the same value of learning rate parameter
- Use the same initial random values of weights
- For each rule of weight update, report should include the following: (a) Plot of average error on training data vs Epoch, (b) Confusion matrices for training data and test data
- Compare number of epochs taken for convergence for different update rules.

Task2: Comparison of normalization methods for classification on Image dataset 2

- Model: MLFFNN with 2 hidden layers and tanh activation function
- Loss function: Cross-entropy
- Mode of learning: Mini-batch mode
- Stopping criterion: Change in average error below a threshold
- Weight update rule: AdaM
- Normalization method: (1) No normalization, (2) Batch normalization with post-activation normalization
- Use the same value of learning rate parameter
- Use the same initial random values of weights
- For each normalization method, report should include the following: (a) Plot of average error on training data vs Epoch, (b) Confusion matrices for training data and test data
- Compare number of epochs taken for convergence for normalization methods

Task 3: Stacked autoencoder (with 3 autoencoders) based pre-training of a DFNN based classifier for Image dataset 3

- Model of AANN: 5-layer structure
- Mode of learning for AANNs: Mini-batch mode
- Stopping criterion: Change in average error below a threshold
- Weight update rule: AdaM
- Report should include the confusion matrices for training data and test data, for (a) DFNN trained using only labeled data, (b) DFNN using a stacked autoencoder pretrained using unlabeled data and finetuned using labeled data. DFNN configuration should be the same in both (a) and (b).

Report should also include your observations.