COMP/EECE 7/8740 Neural Networks
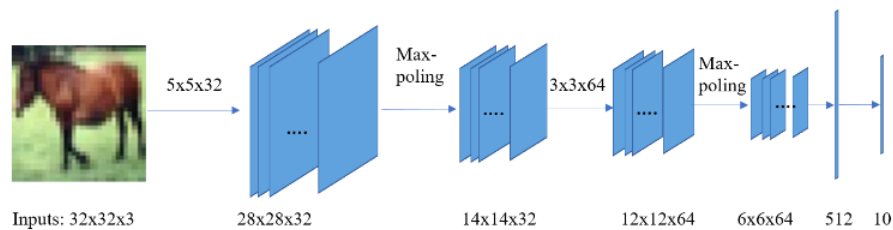## Assignment 2
Fall 2021
Due: September 23, 2021
Total points: 100

Question 1 (Points: 30):

Design a convolutional neural network (CNN) model considering the following criteria:

a) Design a CNN model with following configuration:

b) Activation functions: ReLU
c) Batch normalization
d) Use SoftMax layer for classification
e) Number of epochs: 100 and
f) Batch-size is 32 (you can increase or decrease the batch size if required).
g) Optimizer: SGD with a learning rate and momentum.

Evaluate the model on CIFAR-10 dataset:

a) Input image: 32x32x3 pixels (RGB images)
b) Number of training samples: 50,000
c) Number of testing samples: 10,00
d) Number of classes: 10 (different objects).

Write a report including training logs, testing errors or accuracy, computational times etc.

Note: You may choose a smaller number of sample sets for training and testing if necessary. First, however, you must make sure that an equal number of samples are selected from each class for both sets.

Question 2 (Points: 70):

This assignment aims to develop a Deep Convolutional Neural Networks (DCNN) model and achieve better accuracy for scene understanding or classification tasks.

Dataset: 15-scene

Explore the deep learning codes for the 15-Scene dataset. Download dataset from any of the following links:

https://figshare.com/articles/15-Scene_Image_Dataset/7007177

https://www.kaggle.com/zaiyankhan/15scene-dataset

Download the datasets and prepare as required for training and testing. You can resize the data to 32x32 or 64x64 (depending on the availability of hardware). Use 70% of samples for training and the remaining 30% for testing per category.
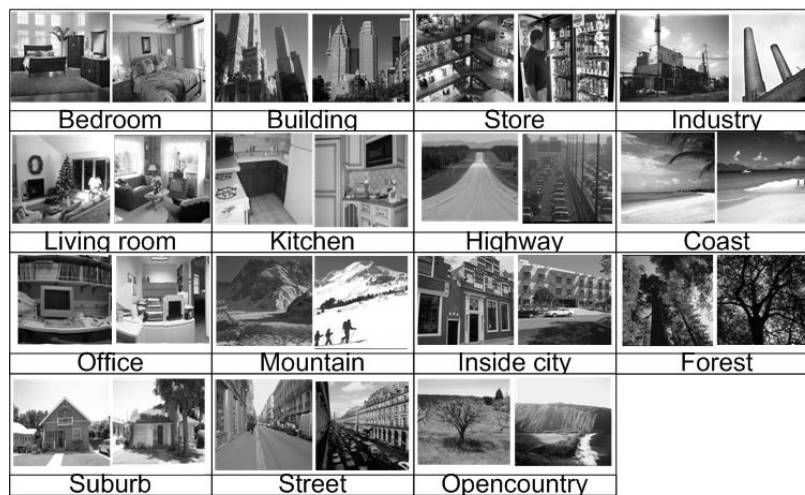

Figure 1. Example images and 15 different types of scenes.

Deep Convolutional Neural Networks (DCNN) model

Implement a DCNN model, which provides better recognition accuracy for the scene classification tasks. For designing a DCNN model, consider the following criterions:

   a. Data augmentation
   b. Better initialization methods (for example: Xavier and He initializer)
   c. Activation function: ELU
   d. Dropout (Regularization)
   e. Batch normalization

2. Evaluated the performance of the model for different optimization function:
   a. SGD
   b. Adam
   c. RMSProp

Write a report including training logs (accuracy and losses), testing accuracy, computational times, and comparison for different optimization and initialization methods.

Report outlines: the report will be included:

1. The title page contains the course title, number, your name, ID, and assignment number.
2. Introduction
3. Methodology
4. Deep Learning Architecture
5. Experiment and Results
   i. Training and testing logs
   ii. Discussion and comparison (if necessary)
6. Conclusion
7. References (if available)