AML Assignment 3 **Due Date: 10th Nov. 2019** **Total Marks: 150**

Instructions: You are allowed to discuss but the final answer should be your own. Any instance of cheating will be considered as academic dishonesty and penalty will be applied.

Database for Q1, and Q2: CIFAR10 (https://www.cs.toronto.edu/~kriz/cifar.html)

Q1) Build a convolutional autoencoder of the following specifications: The architecture of the encoding layer is [**block1:** conv [3x3x*x32], pool (2,2)], [**block2:** conv [3x3x*x64], pool (2,2)], [**block3:** conv [3x3x*x128], pool (2,2)] and decoding layer is [**block1:** dconv [3x3x*x32], unpool (2,2)], [**block2:** deconv [3x3x*x64], unpool (2,2)], [**block3:** deconv [3x3x*x128], unpool (2,2)]. To train convolutional autoencoder, use labeled training data (view this as a multiloss function - one for classification and one for reconstructions). Adapt the encoded representation of the convolutional autoencoder by replacing the decoding layer with the FC+softmax layer and train on the labeled training data and compute test accuracy on test data of the database.

Report the testing accuracies obtained. **Maximum Marks: 30**

Q2) Build a CNN architecture of the following specifications: The architecture of the convolutional layers are [**block1:** [3x3x*x16] x 2], [**block2:** [3x3x*x32] x 2], [**block3:** [3x3x*x64] x 2] (pooling is an optional layer, use according to your requirement). Perform the following tasks to analyze the CNN architecture:

A. Implement a CNN architecture with block1, block2, and block3, followed by 2 FC (Fully Connected) layers and a softmax layer. Apply the Tanh and ReLU activation function on all layers.
B. Implement Dropout and use i) After convolutional layers, ii) Between FC layers.

Analyze the CNN performance for each of the above-mentioned tasks.
Specifications: Analysis should be based on testing accuracy, training and testing loss per epoch, and gradient of the parameters. Use 100 epochs to train the network.

1) Analyze the accuracy, loss, and gradient while adding block 1, block 2 and block 3
2) Analyze the accuracy, loss, and gradient while applying the above-mentioned activation functions
3) Analyze the accuracy, loss, and gradient while changing the dropout probability [0.2, 0.4, 0.6]

Maximum Marks: 50

Q3. Build 5 layers CNN architecture and implement batch normalization and use after each convolutional layers. Initialize the network with two different techniques such as Xavier and Random. Use the STL-10 database for experiments. https://cs.stanford.edu/~acoates/stl10/
Use 50, 100, 150 epochs to train the network and Analyze the CNN performance for each of the above-mentioned scenarios. **Maximum Marks: 40**

Q4. Build a 6 layers CNN architecture to **perform multi-tasking i.e., object segmentation and object recognition using TinyImageNet https://tiny-imagenet.herokuapp.com/.**
OR
Q4. Build a 6 layers CNN architecture to **perform multi-tasking i.e., gender classification and age estimation using the Wiki face database. (https://data.vision.ee.ethz.ch/cvl/rrothe/imdb-wiki/)**

Analyze the accuracy, loss, and gradient corresponding to each task **Maximum Marks: 30**