**CS6406 Assignment 9: CNN**

**Due May 7 2018, 11:59PM, submitted via Canvas**

**This project will implement the Convolutional Neural Networks (CNN) to classify face images from background images. Two datasets are uploaded (one for training and the other for testing).**

**Problem 1: Build a CNN from scratches**

A starter code, which is not workable, is provided for you to understand how to implement CNN in Matlab. Try the following techniques to make the code work and report your observations:

(1). Use different “MiniBatchSize” in the trainingOptions;

(2). Use different “InitialLearnRate” in the trianingOptions;

(3). Add crossChannelNormalizationLayer in the CNN architecture;

(4). Add dropoutLayer before the fullyConnectedLayer;

(5). Add data augmentation in the imageInputLayer;

(6). Make the network deeper by adding more convolution2dLayer, reluLayer, maxPooling2dLayer, fullyConnectedLayer

You may need to reset the “MaxEpochs” in the trainingOptions.

For each of the above trial, learn the convnet from the training dataset, and infer the label of test images (face or background). Report the accuracy.

**Problem 2: Transfer learning using a pretrained CNN**

A CNN is pretrained using a digit dataset (10-class, 10000 images). You can transfer the pre-trained network to our face detection problem (2-class). A starter code is provided.

(1). Load the pretrained network;

(2). Keep all the layers in the pretrained network except the last three layers;

(3). Change the last three layers to the 2-class problem;

(4). Using the face image dataset to re-train the network.

Report your accuracy using the transfer learning.

Note 1: you may need to increase the learning rate of the last three layers by setting values of 'WeightLearnRateFactor' and 'BiasLearnRateFactor' in the layer.

Note 2: since you are fine-tuning the pre-trained network, you may use a small InitialLearnRate to keep the features from the early layers.

Note 3: since the input images in the pre-trained network and images in our dataset are not with the same size, a new image reader function is included in the starter code.

**Upload running Matlab codes and a written report to Canvas by the due date & time including**

a) Brief summary of what you think the project was about,

b) Brief outline of the algorithmic approach,

c) Pictures of intermediate or final results that convince us that the program does what you think it does.

d) Any design decisions you had to make and your experimental observations. What do you observe about the behavior of your program when you run it? Does it seem to work the way you think it should? Play around a little with different setting to see what happens. Note, your open-ended exploration is highly valued.

Note: zip all your files in a folder and provide a readme file so our TA can know how to run your codes.